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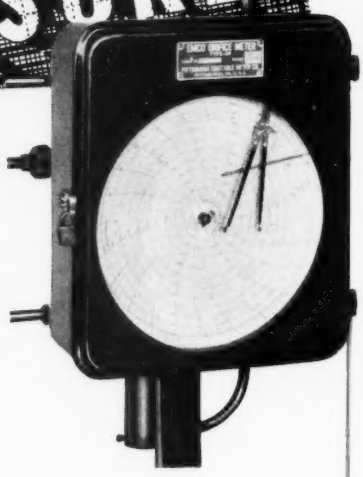

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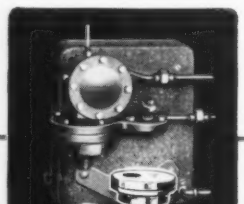

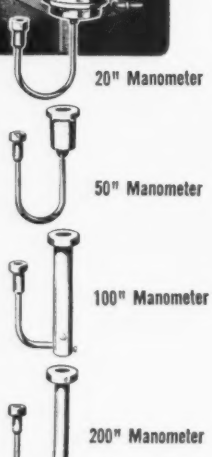

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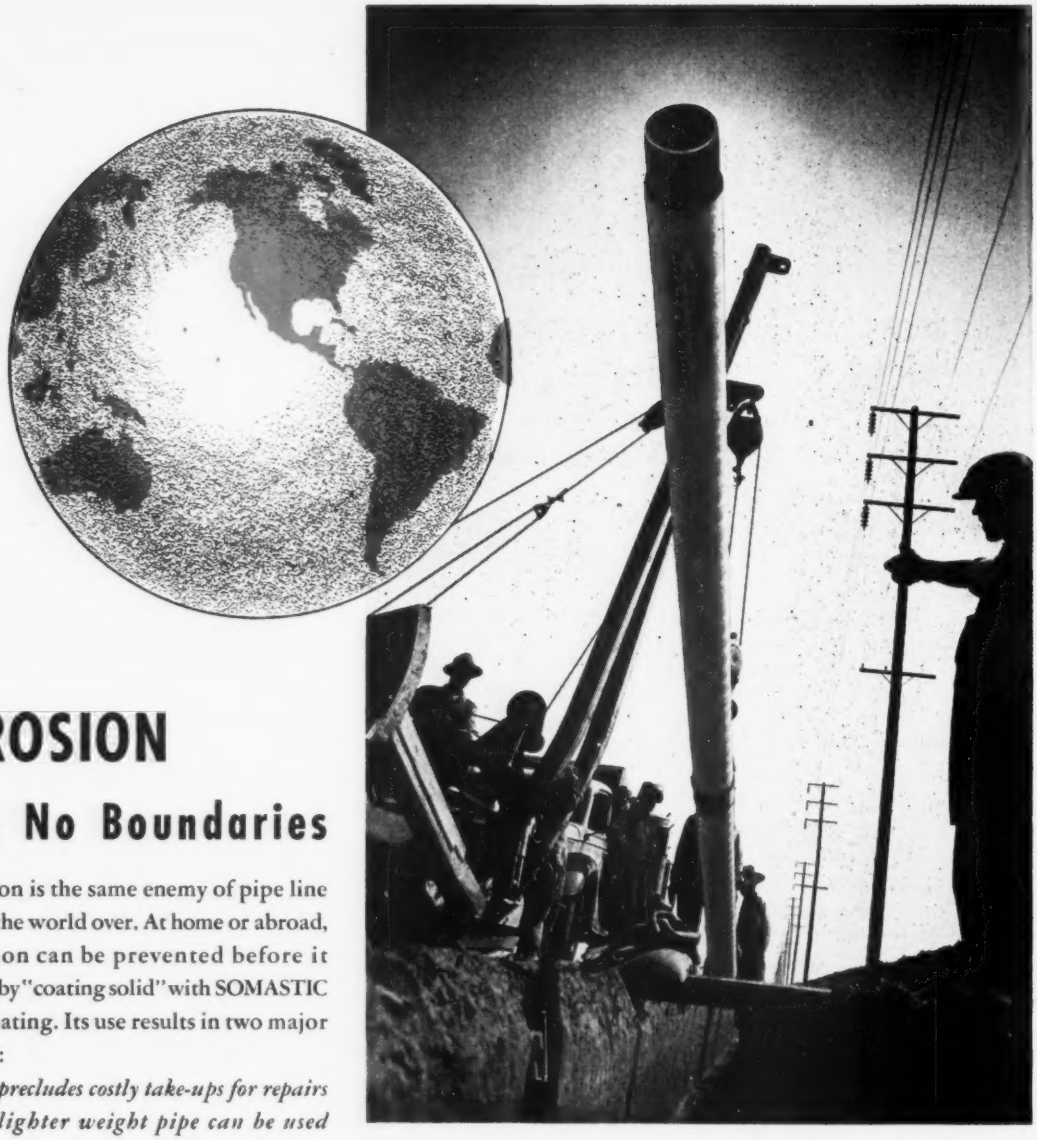

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Outside the U. S.

DESPITE conditions which reflect the fact that effective peace has been slow in arriving over a large part of the world, the oil business outside the boundaries of the United States established new production records in the year now closing.

As explained in the detailed data of this International Number, the output of important oil areas—notably the East Indies and the U.S.S.R.—continues substantially below their prewar levels. Either lack of materials and manpower or unsettled political conditions are responsible for delays in the rehabilitation of the war-devastated oil areas, but greater progress is in prospect for the coming year.

Growth during 1946 centered in Venezuela and parts of the Middle East where private operators were permitted to expand old and new oil properties, until these two areas now rank second and third respectively in world oil production. Exploration in these and other countries as measured in proven reserves assures consumers of adequate petroleum supplies wherever they are needed.

It has not been possible for refining capacity to keep pace with enlarged field output. New plant construction will be a feature of petroleum activities in several countries next year and over the remainder of this decade, an expansion which must also include the large-scale rehabilitation and modernization of refineries which were located within the war areas.

Total tanker capacity with ownership centering in this country is impressive but it will be added to by European marine operators who have construction programs under way to replace units lost during the war, thus regaining their prewar positions in the transportation of oil. It is also noteworthy that in international oil operations, as in this country, more and more stress is being placed on pipe-line transportation of petroleum from and to inland points.

Then there are the 2 billion people who collectively consume about one-half as much petroleum as do the 140 million people of this country. The leadership of these hundreds of millions of people is aware as never before that economic progress and petroleum utilization parallel. Petroleum consumption has become an accurate gage of comparative standards of living among nations.

Private companies are ready to develop new petroleum markets. Cooperation on the part of governments is necessary. Existing markets cannot be enlarged or new outlets created where petroleum is looked upon as a luxury commodity and taxed as such. The results of prohibitive taxes were apparent in the wide variations in per capita petroleum demands in the 1930's. The future balance in petroleum supply and demand is largely dependent on sound operating policies in world-wide distribution.

H A P P Y N E W Y E A R

Regional Suits Planned to Replace "Mother Hubbard" Antitrust Case

by Henry D. Ralph

WASHINGTON.—The "Mother Hubbard" antitrust suit against the American Petroleum Institute and 21 major oil companies probably will never be brought to trial, but it will be kept on the court docket until the Department of Justice has something else to take its place.

This will be a series of separate but more or less related suits against smaller groups or single majors, or against regional practices alleged to exist in certain areas, and charging specific acts in violation of the antitrust laws. Taken together these lesser suits will cover almost as much ground as the Mother Hubbard complaint, but they will avoid broad generalities and attempt to pin definite violations against named defendants instead of indicting the entire industry on blanket charges.

This course of action was decided on by the antitrust division some time ago, but it wanted to get the A.P.I. suit out of the way first. The attorney general is understood to have agreed with the objective but to have criticized the procedure. So the other suits will be filed first and then the Mother Hubbard dropped. This will prevent the public from getting the impression that the majors have won a great legal victory or that the department has whitewashed them. Meanwhile, the A.P.I. case will remain on the books and could be prosecuted if other plans go awry, or it could be amended and cut down to whatever practices are not covered by the separate cases and which the department feels could be substantiated on trial against all major defendants, or most of them.

It is more than likely that the A.P.I. itself will not be made a defendant in the new series of cases. One of the principal charges against the Institute is that it permitted itself to be a tool of the major "conspirators" who used its meetings as a convenient gathering place to further their alleged agreements to restrain trade. Whether or not this charge could be made to stick as of 1940, when the suit was filed, it is improbable that the Government could prove that this situation prevails at the present time.

The Mother Hubbard suit was one of Thurman Arnold's ideas for attacking an entire industry in a single effort to clean up all allegations of improper competitive practices. Tom Clark, who succeeded Arnold as head of the antitrust division and now is attorney general, dislikes this "shotgun" approach and prefers more selective weapons of enforcement. Clark is convinced that competition is being suppressed by the continued growth of the larger companies in many industries and that vigorous antitrust enforcement is the answer.

Divorcement, divestiture, and breaking up of large integrated corporations, Clark feels, is the best enforcement method when a court finds that the antitrust law has been violated. Fines mean virtually nothing, he believes, and the public gets no relief if a corporation executive is sent to jail, but disintegration is an economic remedy which both punishes the violator and benefits competitors.

Except in so far as it prayed for "such other relief" as the court might see fit to grant, the Mother Hubbard suit did not seek divorcement of pipe-line ownership nor disintegration of the major oil companies. However, some of the new suits might specifically seek divestiture of transportation facilities or divorcement of marketing operations from production and refining in the case of a number of majors.

Texas Commission Trims January Allowable 83,000 Bbl. Daily

by Carl F. Hoot

WHILE purchasers asked a total of 2,423,960 bbl. daily, the Texas Railroad Commission followed the U. S. Bureau of Mines recommendation for lower production and reduced the January allowable 83,034 bbl. daily under the figure originally set for December.

The January order, for an allowable of 2,050,584 bbl. daily, issued following the state-wide demand hearing December 20, is designed to allow production of 1,922,422 bbl. daily. The Bureau of Mines estimate of January market demand for crude from the nation's major producing state was 2,030,000 bbl. daily. The January allowable is 98,924 bbl. daily under the December 14 allowable and 108,976 bbl. daily under that for December 21.

The commission fixed production of natural gasoline and distillates in January at an additional 183,325 bbl. daily.

The greatest cutback was in West Texas where the Midland district was allocated 488,413 bbl. daily in January, compared with 534,460 bbl. daily the previous month. The San Angelo district was down slightly, to 29,571 bbl. daily in January—a decrease of 891 bbl. The combined allowable for the two areas of 517,984 bbl. daily represents the approximate pipe-line capacity.

East Texas production was reduced 14,534 bbl. daily, to 303,866 bbl. by reducing the number of producing days from 21 to 20 in January. West Texas producing days will be 18 in January, down 2, and the state generally will have 22 days instead of 23.

Other matters before the commission included revisions in its plan of authorizing and allocating oil production. One proposed plan was that West Texas oil, containing sulfur, and requiring special refinery equipment, be kept separate from other oil in determining the market demand. Another proposal was that the commission base its orders on "consumptive" demand, including distillates. Right of the commission to consider consumptive demand, as distinguished from market demand, immediately was challenged with contention that the commission is wrongly discriminating against oil that purchasers want to place in storage.

Notice was given at the hearing that at the next state-wide hearing, to be held January 15, the commission will consider establishment of a definite deviation rule in drilling.

Thompson Named Chairman

Ernest O. Thompson, member of the Texas Railroad Commission since 1932, last week was elected to a 2-year term as chairman of the state regulatory body to succeed Olin Culberson, who retires as chairman at the end of this year. William J. Murray, Jr., Houston, will become a member of the board January 21 to fill the post being vacated by Beauford H. Jester, who is resigning to become governor.

Russia's Right to Pipe Contract Denied by Court Decision

THE Russian Government has been denied the right to take over a contract which the U. S. Treasury held with the A. O. Smith Corp., Milwaukee, for 183 miles of large-diameter steel pipe line.

The decision, rendered in the United States District Court of Western Texas, El Paso, ended a litigation which had been started when charges were made that the efforts of the Russians would seriously interfere with the supply of natural gas to more than a million residents of southern California.

The decision came as the result of a stipulation presented to the court by A. O. Smith and five other large domestic companies whose interests were involved. The stipulation set forth a plan for the allotment of Smith's production of pipe which was satisfactory to the companies. In addition, A. O. Smith asked the court to rule on whether Russia had a legal right to step in. The court approved the stipulation and ruled that Russia had no rights in the matter.

The stipulation further provided that any purchaser could procure pipe from A. O. Smith outside the agreed allotments if the purchaser could provide the steel, and if A. O. Smith's pipe mill were not operating at capacity. The possibility of available pipe-mill capacity arises out of current uncertainties in the supply of steel.

Today's decision ended a court action which was started 2 months ago after Governor Warren of California, in a telegram to the State Department, charged that A. O. Smith had given preferential position to an order for pipe which he claimed was placed by the Russian Government. He suggested that the filling of the order would delay construction by El Paso Natural Gas Co. of part of the Texas-Los Angeles gas pipe line.

Smith Corp.'s Answer

A. O. Smith promptly answered that it had no order from the Russian Government. It said that it did have an order from the United States Treasury Department for 183 miles of pipe, that the treasury order had been placed before the El Paso order and that A. O. Smith had no choice but to fill it first.

The Treasury Department had placed the order for the United Nations Relief and Rehabilitation Administration and UNRRA in turn planned delivery of the pipe to the Ukraine district of the U.S.S.R.

Later the Treasury Department cancelled its order. The El Paso company, however, went to a state court in Texas for an injunction which would prevent A. O. Smith from accepting any order from Russia, or anyone else, until its own order for 764 miles of pipe was completed.

The case subsequently was transferred to the federal court, and a petition for intervention was filed by five companies which either had orders with A. O. Smith or would be affected by the delivery of pipe to other companies if El Paso's claim to priority over them, as well as over Russia, should win court sanction.

The companies were Panhandle Eastern Pipeline Co., Natural Gas Pipeline Co. of America, Texoma Natural Gas Co., Chicago District Pipeline Co., and The Texas Co.

Under the stipulation, the El Paso company is to get 341 miles of its original order, and by procuring its own steel, it hopes to complete its Texas-California line by utilizing available capacity of the A. O. Smith mill.

A.P.I. Seeks Support for Launching Its Public-Relations Program

NEW YORK.—More than 35,000 oil companies in all branches of the petroleum industry are to be enlisted in the nation-wide public-relations program of the American Petroleum Institute, according to William R. Boyd, Jr., A.P.I. president.

State, local, and district committees, covering the production, refining, transportation, natural gas, natural gasoline, and marketing branches, as well as supply and equipment houses, are to be organized.

Information on the survey and program activities is to be released within the next 6 weeks, with emphasis on how the public's misunderstanding of the oil business can be corrected.

All Segments Solicited

As part of the initial organization work, members of the operating committee and others familiar with the program will present details to petroleum trade associations and at other industry meetings in all parts of the country. Under the plan recommended by the operating committee, it is expected that district organizations, growing out of the activities of the district organizing committees, will be functioning shortly after the first of the year.

A.P.I. officials said these district committees will represent and seek participation of all segments of the industry in carrying out of the public-relations work and also will solicit financial support of every company.

The operating committee functions under the main A.P.I. public-relations committee. The recent first meeting of this newly enlarged main committee, of which John M. Lovejoy, president of Seaboard Oil Co. of Delaware, is chairman, marked the launching of the industry's public-relations program.

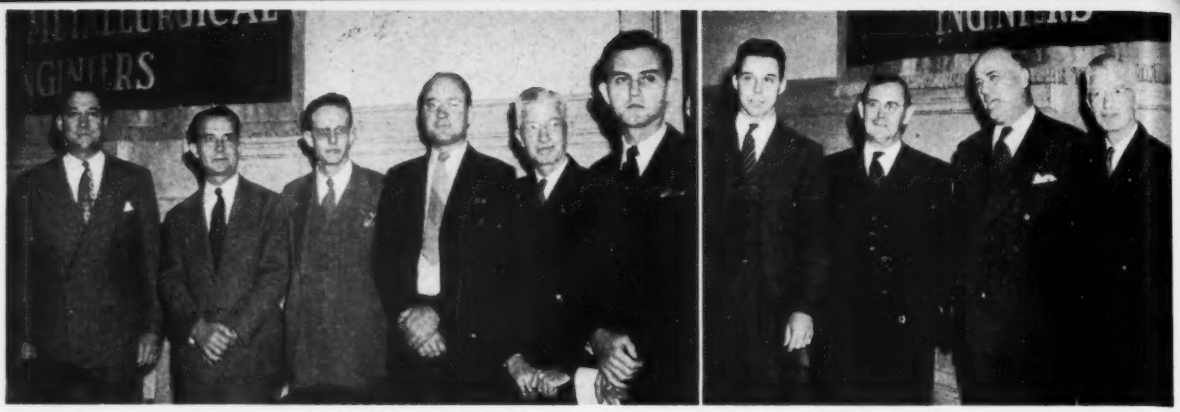
Supervision and direction of the program will be under the operating committee, a new name for the A.P.I. advisory subcommittee on public relations. R. T. Haslam, vice president of Standard Oil Co. (N.J.), is chairman and Franklyn Waltman, public-relations director, Sun Oil Co., vice chairman. Ralph Champlin, Ethyl Corp., is second vice chairman. The Fred Eldean Organization was retained as public-relations counsel to manage the program.

Phillips Negotiating for Danciger's Refinery

Negotiations looking toward the purchase of Danciger Oil & Refining Co.'s Pampa, Tex., refinery by Phillips Petroleum Co. are reported to be under way. The Pampa refinery, of 7,000 bbl. daily crude capacity and 3,500 bbl. daily cracking, was shut down recently. The negotiations, expected to be completed shortly after January 1, also involve Danciger's crude gathering system in Panhandle field of Texas, according to Joe Danciger, vice president of the company.

Return of Deposits on Bids Will Be Speeded

WASHINGTON. — Arrangements have been completed whereby cash deposits accompanying bids for development rights on public lands can be returned to unsuccessful bidders on the same day the bids are opened, according to an announcement by the Bureau of Land Management.



Left: Members of all sections in Texas participated in the meeting, including: Paul R. Turnbull, Humble Oil & Refining Co., Corpus Christi, chairman of the newest Southwest section; Riley Aucoin, Humble Oil & Refining Co., Tyler, chairman, East Texas section; Gordon Fisher, Gulf Oil Corp., Fort Worth, member of the program committee for North Texas; W. L. Crothers, Humble Oil & Refining Co., Midland, vice chairman-elect, Permian section; Herbert Poyner, chairman, University of Texas Student Society, and H. H. Power, University of Texas, chairman of the arrangements committee. Right: Present at the final dinner were C. R. Hocott, Humble Oil & Refining Co., Houston, representing Herbert F. Beardmore, Petroleum Division chairman, who was delayed en route to the meeting; President T. S. Painter, University of Texas; Olin Culberson, Texas railroad commissioner, and H. H. Power, chairman, department of petroleum engineering, University of Texas

Gas Conservation Considered by Engineers at Texas A.I.M.E. Meet

by George Weber

TEXAS members of A.I.M.E. took a long look at gas conservation, the future of the oil industry, and their future in it during the 2-day all-Texas meeting held December 18-19 in Austin. Reservoir engineering, cycling economics, and salt-water disposal also came up for discussion, but the range of other subjects from personal and collective introspection to far future developments as influenced by present practices, introduced a comprehensive tone not usually found in technical sessions of that type.

The first of a proposed succession of such annual meetings, the session was conceived and organized by student members of the University of Texas (A.I.M.E.) Affiliated Student Society with the cooperation of the Texas A. & M. College society. Meetings were held on the university campus.

Participation in the program was shared by industry members from the institute's five state sections as well as others from Oklahoma and California. The occasion underscored the growth of A.I.M.E. in Texas, where sections in North Texas, the Permian basin and the Southwest have augmented the original Gulf Coast and East Texas groups since 1944.

West Texas gas, predominantly of the casinghead variety, was considered in the opening session. Gas-conservation practices in that district were reviewed by D. V. Carter, chief petroleum engineer, Magnolia Petroleum Co., who found that the increasing demand for such gas, giving it new value was a major factor in its growing conservation.

The greatest single project affecting gas demand in the Permian basin was covered by W. K. Davis, El Paso Natural Gas Co. who gave a progress report on his company's new pipe line to California, the basin's first major outlet for casinghead gas. (This paper appears on pages 275-278, this issue.)

In reviewing cycling progress and trends in uses of South Texas gas, C. R. Williams, vice president of The Chicago Corp., pointed to future increases in gas prices but condemned the current interpretations being placed on provisions of the Natural Gas Act by governmental agencies, stating that interference from that direction is restricting gas use since some producers are reluctant to close contracts with transmission companies engaged in interstate commerce. The economics of cycling were outlined by W. H. Justice, Tide Water Associated Oil Co., who highlighted the benefits of such operations in a hypothetical example of a typical gas condensate field.

A comprehensive reservoir study of the West Edmond Hunton pool in Oklahoma was presented by Max Littlefield, L. L. Gray, and A. C. Godbold, of Gulf Oil Corp.,

The second day found members digressing from the usual subjects to consider their relationship as engineers with management on one hand and labor on the other, with the opening remarks of Dean W. R. Woolrich of the college of engineering, their responsibilities as scientists and engineers to civilization in general. Tremendous progress in the sciences, outstripping similar advancement in the humanities has led a number of Texas engineers to devote serious thought to the lack of moral balance evidenced in recent scientific achievement.

Reviews of the subject "What Management Expects of an Engineer" and "What Engineers Expect of Management" were presented. These two California papers, written by A. C. Rubel, vice president of Union Oil Co. of California, and Ernest K. Parks, consultant, were followed by still another study in engineer relations, "The Engineer as a Supervisor," by Thomas C. Frick, Atlantic Refining Co. Another projection of thought outside the usual technical channels was directed by H. H. Power, University of Texas petroleum engineering school, who discussed in detail the probable substitutes for petroleum when such auxiliary reserves become financially practical in an economy of declining oil reserves.

In the closing session, students presented papers on reservoir study, conservation and high-pressure gas corrosion. Jack W. Waechter, a junior petroleum engineering student at University of Texas, reviewing the latter subject received the cash prize awarded by the Gulf Coast section for the best student paper of the year. His school will receive an award plaque from the Petroleum Division of A.I.M.E. for this same work.

Exceeding most premeeting estimates, registration totaled 325, including 93 full members, 39 guests, and 193 students, from both the host university and Texas A. & M. College. The joint all-Texas meeting is proposed as an annual event, which will rotate among the state universities and colleges maintaining petroleum-engineering schools.

THIS 1946 S M T W T F S WEEK

THE GOVERNMENT—Sources in Washington say the Department of Justice will replace the omnibus "Mother Hubbard" antitrust suit with a series of regional actions against smaller groups or single companies. . . . Attorney-General Clark has received the antitrust division's recommendation to dismiss the "Mother Hubbard" case but is understood to favor filing the other suits before dropping the 6-year-old omnibus complaint. . . . ¶Interior Secretary Krug again expresses confidence in a future for the National Petroleum Council in replying to E. B. Reeser, who resigned from council because of legal restrictions on its functions. . . .

TRANSPORTATION—Court action filed by El Paso Natural Gas against A. O. Smith Corp. ends in stipulated decision by which Smith's pipe production is allotted under plan satisfactory to five U. S. companies. . . . Decision by federal judge in El Paso, Tex., holds Russian Government cannot take over contract placed by U. S. Treasury Department. . . . ¶Per-well take from Rangely field increased from 135 to 150 bbl. daily by Indiana Standard's purchasing department. . . . ¶Maritime Commission summary shows 91 surplus tankers sold to the end of November—47 to U. S. operators and 44 for foreign registry. . . .

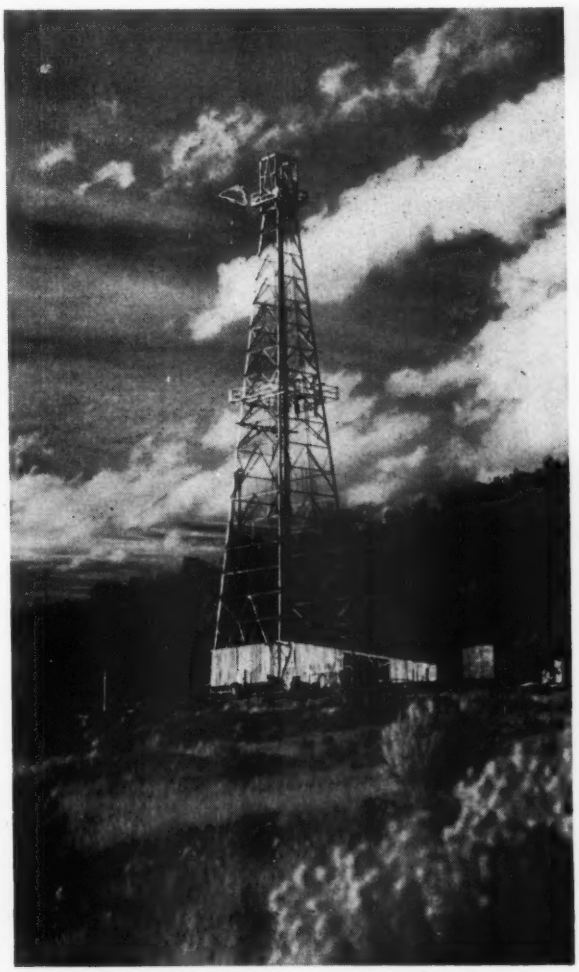
PRODUCTION—Texas Railroad Commission fixes January allowable at 2,050,584 bbl. daily, lower than any month in 1946 and some 83,000 bbl. under the original December allowable. . . . ¶Oklahoma Corporation Commission recesses hearing on proposal to unitize West Cement Medrano production after a day of testimony in which Phillips engineers explain merits of plan. . . . Opposition from some royalty interests develops. . . .

INTERNATIONAL—Intava, Inc., and Standard-Vacuum contract with Joint Army-Navy Petroleum Purchasing Agency for servicing U. S. military airports throughout the world. . . . ¶Mexican Government grants first private exploration and development contract since expropriation to Hilario Millan, a Mexican national. . . . Contract covering 74,000 acres on Mexico's west coast marked by restrictions favoring the government. . . . ¶Standard of New Jersey announces settlement of three suits brought by minority stockholders in Creole. . . . ¶New administration in Mexico cracks down on Pemex labor leaders. . . . Another strike flareup brings discharge to 50 and order for troops to operate oil installations. . . .

MARKETS—Activity in products markets continues extremely strong, partly as a result of efforts to complete shipments before higher freight rates take effect January 1. . . . ¶Washington officials warn that nonhousing construction, including filling stations, still requires government permit, despite the general relaxing of U. S. controls. . . .

IMPORTS—I.P.A.A. makes lead-off move in coming import fight. . . . Association files petition with Committee for Reciprocity Information asking that previous reductions in duty on crude and products be restored and that oil import quotas be established. . . . ¶October figures released by Census Bureau show crude imports dropped to 231,000 bbl. daily from 275,000 bbl. daily in September. . . .

THE BIG-INCH—Six connections completed in Ohio, West Virginia, and Pennsylvania to take gas from big-inch lines during their emergency operation this winter by Tennessee Gas & Transmission Co. . . . Pennsylvania governor authorizes gas withdrawal from the state's big-inch connections in view of the winter fuel shortage. . . .



Development of a new oil field in Moffatt County, northwestern Colorado, is expected soon as a result of the recent discovery by the wildcat 1 Margaret Smith drilled by Continental Oil Co. near Elk Springs, 28 miles northeast of Rangely field and 55 miles southwest of Craig, Colo. Production is in the Weber sand at 6,097 to 6,126 ft., the same zone from which oil is produced in Rangely. Continental holds a block of 2,164 acres in the new area

International

WORLD-WIDE OIL DEVELOPMENTS

Limited Private Concession Contract Granted Mexican National

MEXICO CITY. — An exploration and development contract with Hilario Millan, a Mexican national of San Ignacio, has been signed by the Mexican Government giving Millan a limited concession of 30,000 hectares (74,100 acres) in the state of Sinaloa on the west coast of Mexico.

The Sinaloa concession, first offered last July, was the first bid for private development made to Mexico since it expropriated foreign oil-company holdings in 1938.

The contract, signed in mid-November, provides that Millan shall drill "at least three wells during the first 3 years" of the 30-year maximum lease, and that 12.5 per cent of all production will be at the disposition of the government.

Millan will retain 87.5 per cent of the total production "which without detriment to the field may be utilized," except that he may be required to sell a part or all of his production to the government. "when the public needs, in the judgment of the federal executive, so require."

Another clause of the contract provides: "Upon obtaining commercially profitable production, the secretariat . . . will incorporate in the petroleum reserve, half of the zone that may have proven productive, and . . . will determine the program to be followed in the development of the remainder in order to guarantee the most suitable development of the field, in accordance with the findings of the exploration."

According to the contract, any agreement with a third party for carrying out a part of the work "may only be concluded with and in favor of Mexican citizens, or companies wholly formed by Mexicans."

Millan is required by the contract to provide the government with all geological and other data resulting from his operations and is prohibited from hiring other than Mexican employes, except that he may hire specialists not available in Mexico with government approval.

Another provision requires the contractor to accept a number of Mexican students who are preparing for the petroleum industry.

The contract was signed November 19, following Millan's posting of a bond of 30,000 pesos (about $6,200) and before the installation of Mexico.'s new administration, headed by President Miguel Aleman.

Recent statements of Antonio J. Bermudez, newly appointed chief of Petroleos Mexicanos, and Antonio Ruiz Galindo, secretary of national economy, have suggested to observers that the matter of outside capital for Mexican oil development may be kept under consideration.

Bermudez told reporters that while Pemex contemplates no change in its current operations, both private and government capital, within Mexico, will be sought to improve the operations of Pemex.

Galindo, under whose jurisdiction Pemex soon may operate, said he always has favored private enterprise in petroleum as well as in other industrial fields.

U.N. Projects Conference On Oil, Other Resources

NEW YORK. — An international conference on the conservation and utilization of petroleum and other natural resources has been tentatively scheduled by the United Nations Economic and Social Council for the last 3 months of next year.

At some scheduled date before next October a preparatory commission probably will meet and assemble data for the conference, a U.N. spokesman told The Oil and Gas Journal this week.

This is the same conference which President Truman proposed earlier this year in the belief that the last war had seriously depleted the world's natural resources and that the stewardship of these resources should, in part, be a U.N. consideration.

Among topics slated to be discussed at the international resources meeting are: Over-all world needs, broken down by countries; new development techniques; new manufacturing processes; hydrogenation; and local administration of products after they have been taken out of the ground.

When the international natural-resources meeting is held, next year or maybe not until 1948, it is certain that representatives from Russia, as well as from all other countries with an interest in the production of oil and other resources, will be invited to participate.

Moreover, it is understood that particular emphasis will be placed on the desirability of open publication of production statistics of each country. And if Russia's new and current conciliatory attitude on international cooperation portends a long-range policy, U.N. representatives vision a considerable degree of success.

Arabian American Given UNRRA Crude Contract

NEW YORK. — Arabian American Oil Co. this week was awarded a contract by the United Nations' Relief and Rehabilitation Administration, acting through the U. S. Navy, to furnish 1,000,000 bbl. of crude oil for use in Italian refineries. Contract price is reported to be $1.17 per bbl., f.o.b., Ras Tanura, 4 cents higher than that for 999,000 bbl. sold under two previous contracts.

Specifications on which bids were requested called for crude of 34°-37° gravity A.P.I. with a maximum of 1.7 per cent sulfur and 1 per cent b.s. and w. The oil is for January-February delivery. The previous two bids were for 787,000 bbl. and 212,000 bbl., with Arabian American the low bidder each time.

Russia's Oil-Equipment Needs Placed at $20,000,000 Annually

NEW YORK.—Twenty million dollars a year of drilling and refining equipment will be needed by Russia over the next few years, according to E. C. Ropes, chief of the Russian section, Department of Commerce, speaking here before the Commerce and Industry Association.

Ropes said that "American business men may look forward to selling and servicing their goods in the Soviet Union from their own offices there whether they have technical-assistance contracts or not."

To facilitate this abrupt change of the status quo, the Department of Commerce official said that the Russian Ministry of Foreign Trade has accepted United States proposals for a series of trade conferences, which probably will be held in Washington within the next few months. The department's trade mission, sent to Moscow last summer, has already discussed the broad lines for the probable development of new trade relations with Russia, Ropes said.

Ropes' disclosure followed a Moscow dispatch which indicated the entire Russian policy may be more conciliatory insofar as international relations are concerned. However, in view of the $200,000,000 a year worth of all types of industrial equipment, including $50,000,000 for railroads, which Ropes said will be needed, the new Russian policy is based on a most realistic situation, other observers point out, "and not mere ideological retrenchment."

Aside from $20,000,000 worth of petroleum equipment as such, Ropes said that the Soviet's yearly needs will include $20,000,000 for steel machinery; $6,000,000 for metals; $16,000,000 for electrical machinery; $10,000,000 for construction equipment; and $20,000,000 for machine tools.

Expansion of Amtorg Trading Corp., Russia's giant purchasing agency, with headquarters in New York, with additional experienced personnel from the Washington Purchasing Commission is well under way, Ropes explained, "and the head of the latter has become the chairman of the former as he well deserves." A. I. Eremin is now president of Amtorg.

Ropes said that the Russians have been most responsive as to the quickest method of putting this large U. S. export program into effect. American companies themselves will have to execute the trade proposals which the Commerce Department is now trying to foster and for that reason will be invited to play an important role in the coming trade conferences, Ropes concluded.

Settlement Reached in Creole Stockholders Suit

NEW YORK.—A total of 750,000 shares, have been returned by Standard Oil Co. (N.J.) to Creole Petroleum Corp., in settlement of three civil actions brought in the Supreme Court here by Creole's minority stockholders.

Jersey Standard now owns 93.1 per cent of the Creole stock and, accordingly, holds a 92.9 per cent equity in the stock returned.

The Creole minority stockholders questioned the ratio of the appraised values of the assets of Creole and Lago Oil & Transport Co., Ltd., in consolidating their Venezuelan operations in August 1943, and also the prices at which Creole crude was sold before the purchase by Creole of Lago's Venezuelan assets.

The settlement provides for the return, by Jersey Standard, of 750,000 shares of the 19,623,254 shares of Creole stock which Creole paid Lago for the transfer of all of Lago's Venezuelan assets to Creole.

In its offer of settlement, Jersey Standard maintained "that all the steps taken by the appraisers, the managements, and the stockholders of the corporations concerned, were taken in good faith and for the best interests of Creole Petroleum Corp. and Lago Petroleum Corp., and that no damage has been sustained" by Creole.

The settlement is subject to final approval of the court after Creole stockholders have been notified.

Pemex Labor Leaders Fired After Walkout

MEXICO CITY. — A 1-day work stoppage in Mexico's petroleum industry resulted last week end in the discharge of about 50 labor leaders held responsible for the walkout. The work stoppage occurred after labor delegates walked out of a wage-negotiation meeting.

Discharge of the leaders and the use of government troops to operate refineries, deliver oil, and act as guard units were ordered by Miguel Aleman, newly inaugurated Mexican president.

Contract Signed for Drilling in Philippines

Col. Andres Soriano, president of Far East Oil Development Co., Inc., of the Philippines, announced last week completion of a contract with Kern Drilling Corp., Long Beach, Calif., for oil-well drilling in the Philippines. The company is resuming the testing of a promising structure on the Island of Cebu which was interrupted by the Japanese invasion. It is also planned to test other areas in the Philippines.

The contractor is assembling complete heavy-duty rotary equipment which will be shipped from the United States shortly after January 1, 1947. Colonel Soriano, Grant Corby, geologist, and Alfred E. Ireland, superintendent, assisted in the negotiation of this agreement.

Seven Drilling Strings Due For Kuwait Oil Operations

NEW YORK.—With seven complete rotary strings on order, Kuwait Oil Co., Ltd., expects to put these into operation early in 1947. Current production of 40,000 bbl. daily, from eight wells, is expected to be increased substantially next year.

Kuwait Oil is jointly owned by Gulf Exploration Co., a subsidiary of Gulf Oil Corp., and the D'Arcy Exploration Co., Ltd., of Anglo-Iranian Oil Co., Ltd.

At present, Shell is lifting approximately 20,000 bbl. daily of crude from Kuwait.

Gulf to Start Soon on Puerto La Cruz Refinery

NEW YORK. — Preliminary construction work on Gulf Oil Corp.'s 20,000-bbl. daily refinery at Puerto la Cruz, Venezuela, is expected to be under way soon.

The refinery, which will be constructed under terms contracted by the Gulf subsidiary, Mene Grande Oil Co., S.A., is to be built either by this subsidiary or its nominee. Herbert Henderson, Gulf's vice president in charge of engineering, will supervise the work.

L.P.G. Sales Soar in 1946

by G. G. Oberfell and R. W. Thomas

This comprehensive review of the growth and development of the liquefied petroleum gas industry for 1946 is an annual study by the authors. G. G. Oberfell is vice president in charge of research and development of Phillips Petroleum Co.; R. W. Thomas is manager of research and development for Phillips. The company holds a leading position in the L.P.G. manufacturing industry. A 33.5 per cent increase in over-all L.P.G. sales in 1946, including a particularly heavy expansion in use for household purposes, is estimated in this article.

ANYONE studying the growth of the liquefied petroleum gas industry will at once recognize the tremendous strides made in volume of product marketed. Particularly is this growth impressive when one considers that as of the end of 1946 the annual marketed volume is 13 times the volume that it was 10 years ago. Not only has the increase in the marketed volume of these products approached staggering proportions but in addition the methods of handling, selling, and utilizing these products have developed to a stage of refinement and acceptance that L.P.G. now is regarded as a necessary and dependable fuel equal to or better than the best available materials for similar use.

The past year is the first full year since mid-1941 in which the industry has operated without any direct wartime restrictions. The development and growth of the industry during 1946 would have reached even greater proportions had it not been so unduly restricted by the same material and manpower shortages as were experienced by most of the other industries in the country during this readjustment period.

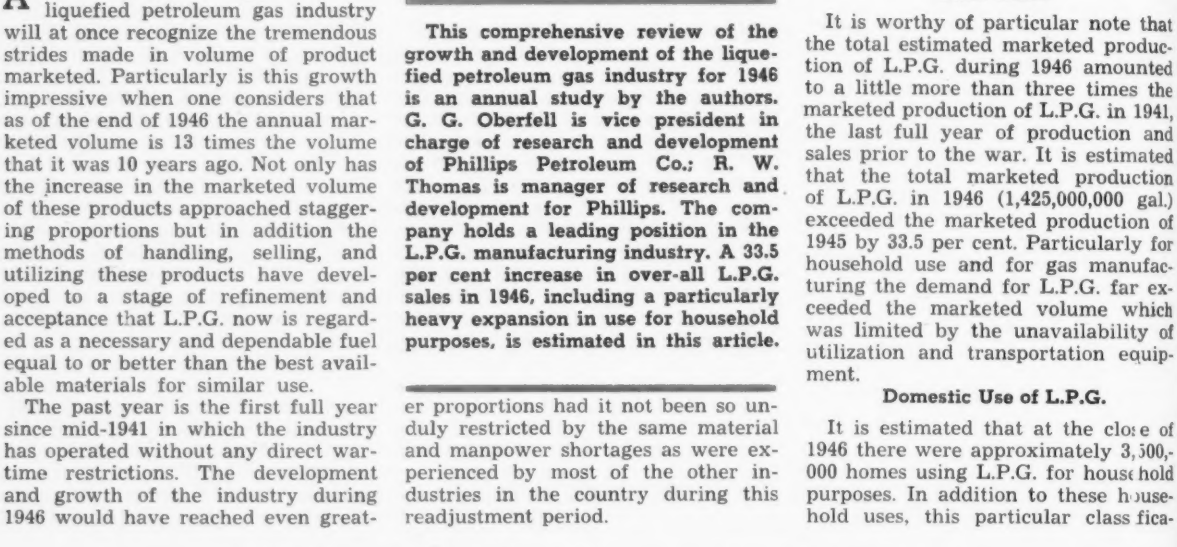
Total Sales

It is worthy of particular note that the total estimated marketed production of L.P.G. during 1946 amounted to a little more than three times the marketed production of L.P.G. in 1941, the last full year of production and sales prior to the war. It is estimated that the total marketed production of L.P.G. in 1946 (1,425,000,000 gal.) exceeded the marketed production of 1945 by 33.5 per cent. Particularly for household use and for gas manufacturing the demand for L.P.G. far exceeded the marketed volume which was limited by the unavailability of utilization and transportation equipment.

Domestic Use of L.P.G.

It is estimated that at the close of 1946 there were approximately 3,500,000 homes using L.P.G. for household purposes. In addition to these household uses, this particular class fica-

Specially built trailer used for delivery and placement of large-sized domestic tanks



tion of marketed production (see "domestic" in the table) includes the many other requirements for which these customers desired L.P.G., such as irrigation pumping, tractor fuel on the large farms and ranches, chicken brooding, and the many other demands that existed for a fuel of this nature. Included in this classification of marketed production there is a considerable volume which was used for industrial purposes, internal combustion engines and for gas-manufacturing purposes. This consumption was tabulated in this classification because it was sold by producers to distributors whose principal sales were for household purposes.

In spite of the shortage of steel for tanks, cylinders, and appliances which limited the number of new installations, the increased use of the gas on the part of continuing customers and the demand on the part of new customers installed during the year brought the total estimated "domestic" consumption to 763,000,000 gal., an increase of 43.1 per cent over 1945. This large increase was possible only because of the initiative and ingenuity displayed by the marketers. One evidence of this was the development of distribution methods by which a far greater number of customers was served with a given number of cylinders than was thought possible a few years ago.

Manufacturers are recognizing the tremendous demand for L.P.G. consuming appliances, and their increased interest in this market is worthy of note. Another interesting trend is the increased use of meters for measuring household consumption.

The past year has seen the greatest demand for new bulk stations, both on the part of companies already in the business as well as by newcomers. This has resulted in making the distribution of L.P.G. to the consumer more economical because of shorter hauls, a factor that brings lower cost to the operator and an advantage in obtaining greater consumer saturation. Indications are that this trend will continue. It is estimated that approximately 2,500 bulk distributing plants are in operation now.

Industrial Use

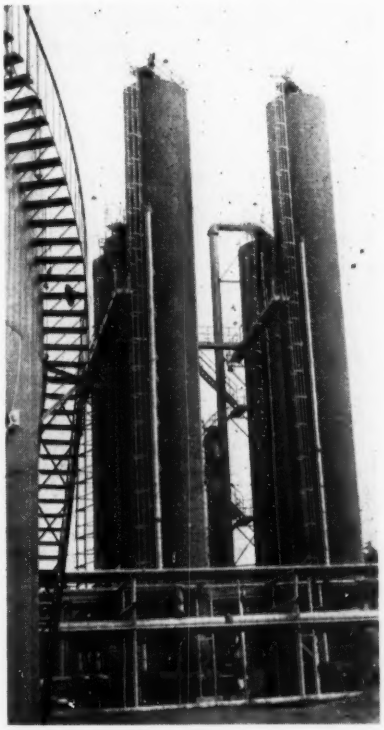
A number of industries were greatly curtailed or completely shut down in the conversion from wartime to peacetime activities, and very little growth in L.P.G. volumes consumed for industrial use was experienced during the past year. Because of material and manpower shortages, an increased demand for L.P.G. in existing industrial installations and in new installations did not materialize. In 1946 it is estimated that 257,000,000 gal. were used. This represents an increase of 0.2 per cent over that consumed in 1945.

In addition to industrial uses, L.P.G. sold directly by producers for fueling internal-combustion engines is included in this tabulation. A certain growth in this use was evident, but much of the product so used was sold by resellers and included in the domestic classification.

With increased distribution of natural gas it is to be expected that some L.P.G. will be replaced with this fuel. In a number of conversions natural gas will be purchased under high-cost peak load prices or with shutoff provisions. In such cases L.P.G. installations will be used for standby. As industrial reconversion progresses and manufacturers build many of their plants which are now in the planning stage, sales for industrial uses will again expand.

Use of L.P.G. by Utilities

The largest percentage increase in consumption for L.P.G. during the past year was by utility companies for gas manufacturing. The estimated sales volume was 80,000,000 gal., an increase of 48.6 per cent over 1945. Many gas-manufacturing plants operated throughout the war years in a state of low efficiency due to inability to secure replacement parts or new equipment. A number of these plants have been converted to L.P.G. during the past year with an appreciable economic advantage. There are now more than 300 towns served by gas-manufacturing plants depending upon L.P.G. for their entire requirements.



Fractionation equipment for recovery of liquefied petroleum gas

An increasing number of homes were converted to natural or manufactured gas for house heating. As a result utilities are experiencing large winter peaks in the demand for house heating. The additional house-heating load has taxed their manufacturing facilities or transmission lines beyond their physical limits, resulting in the need for additional gas producing and transmission facilities. To satisfy this peak-load requirement many utilities are installing L.P.G. storage to supply this periodic deficiency in gas supply. Since the utilities' peak demand occurs at approximately the same time as does that of the L.P.G. industry, it is necessary for the utilities to install sufficient L.P.G. storage to satisfy this seasonal demand. Due to the shortage of steel for manufacturing storage tanks, only a portion of these projected installations were completed in 1946. Part of this huge peak-load demand for L.P.G. may be temporary, pending construction of additional gas-manufacturing facilities or additional natural-gas pipe lines; however, a large portion of this demand can be considered permanent.

Chemical Uses

Liquefied petroleum gases make excellent feed stocks for the production of certain intermediate materials in the manufacture of chemicals. As a result of the impetus given by the war activity in synthesizing a great number of chemicals, this industry has continued to grow since the termination of hostilities.

Assuming that the demands of the same general type of chemical-manufacturing activity are included in this classification as in previous tabulations, it is expected that during 1946 approximately 325,000,000 gal. of L.P.G. will have been consumed. This represents an increase over 1945 of 44.8 per cent. The above consumption excludes the C_3 and C_4 hydrocarbons used for the production of motor fuel, aviation gasoline, and synthetic-rubber components.

Large quantities of L.P.G. are still being used in the manufacture of synthetic-rubber components. The plants employing raw materials derived from petroleum are still in operation and in general have not curtailed their output but rather have endeavored to produce the maximum quantity possible. Therefore the demand for this purpose has been high through 1946 and will probably continue in approximately the same amount through 1947.

Industry Activities

Accompanying the growth of the L.P.G. industry has been the development of high safety standards. This activity has been advanced by national and state associations comprised of industry members, as well as by the organizations of the individual

MARKETED PRODUCTION OF L.P.G.

Year	Total Sales Gal. (in. thou.)	% Inc.	Distribution — 1,000 gal. annually: Domestic(a)	% Inc.	Ind. and misc.	% Inc.	Gas mfg.	% Inc.	Chem mfg.(a)	% Inc.
1922	223	....								
1923	227	24.4								
1924	376	36.0	Sale of L.P.G. confined primarily to bottled-gas business prior to 1928							
1925	404	7.2								
1926	465	15.2								
1927	1,091	134.6								
1928	4,523	314.6	2,600	....	400	....	1,500	....	.....	....
1929	9,931	119.6	5,900	126.9	1,500	275.0	2,500	66.7	.....	....
1930	18,017	81.4	11,800	100.0	2,200	46.7	4,000	60.0	.....	....
1931	28,770	59.7	15,295	29.6	7,172	226.0	6,303	57.6	.....	....
1932	34,115	18.6	16,244	6.2	8,167	13.9	9,703	53.9	.....	....
1933	38,931	14.1	16,626	2.3	13,987	71.3	8,318	—14.3	.....	....
1934	56,427	44.9	17,681	6.3	32,448	132.0	6,298	—24.3	.....	....
1935	76,855	36.2	21,380	20.9	47,894	47.6	7,581	20.4	.....	....
1936	106,652	38.8	30,014	40.4	67,267	40.4	9,371	23.6	.....	....
1937	141,400	32.6	40,823	36.0	62,610	(b)	11,175	19.3	26,792	....
1938	165,201	16.8	57,832	41.7	62,694	0.0	12,386	10.8	32,299	20.5
1939	223,580	35.3	87,530	51.4	93,723	49.4	15,435	24.6	26,892	—16.7
1940	313,456	40.2	134,018	53.1	124,482	34.5	20,285	31.4	34,671	29.0
1941	462,852	47.7	220,722	64.7	172,669	38.6	25,255	24.5	44,206	27.5
1942	585,440	26.5	299,559	35.7	201,447	16.7	31,366	24.2	53,038	20.0
1943	675,233	15.3	339,380	13.3	242,978	20.6	37,519	19.6	55,356	4.4
1944	898,071	33.0	445,617	31.4	254,590	4.8	45,879	22.3	151,985	175.0
1945	1,067,979	19.0	533,262	19.7	256,577	0.8	53,849	17.4	224,291	47.5
1946	1,425,000	33.5	763,000	43.1	257,000	0.2	80,000	48.6	325,000	44.8

(a) Domestic and chemical uses are defined in the accompanying article. (b) Not comparable due to segregation of chemical manufacturing.

Remarks: In this table, "Total sales" for all years except 1946 were obtained from the U. S. Bureau of Mines reports. "Distribution" for the years 1931 to 1945, inclusive, was obtained from the same source. All other volumes were estimated by the writers. The total sales volume includes all liquefied petroleum gases (propane, butane, and propane-butane mixtures) when sold as such. Until 1944 the sale of pentane when sold for any purpose other than motor-fuel blending was included. Since then it has been excluded. It does not include butane when blended with heavier petroleum fractions for motor-fuel purposes. Intercompany sales transactions, such as purchases of liquefied petroleum gases by one company from other companies and resold as liquefied petroleum gases, have been eliminated in order to avoid duplication of sales figures. The data do not reflect sales of liquefied petroleum gases used directly by the producer at the point of production, for fuel, polymerization, solvent dewaxing, etc. Neither do the figures include sales of hydrocarbons to plants manufacturing synthetic rubber or aviation gasoline or their components.

companies. One of the foremost accomplishments in establishing minimum safety requirements was the revision of the National Board of Fire Underwriters Pamphlet 58, "Standards for the Design, Installation, and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases as Recommended by the National Fire Protection Association." The Liquefied Petroleum Gas Association, a national organization, is constantly active in developing these standards. Many states and municipalities have adopted these standards as the basis for statutes and regulations to govern the conduct of the industry's activities.

An effective publicity campaign has been continued during the year by the Liquefied Petroleum Gas Association. Electricity continues to strive for a leading role as competitor to L.P.G. for the household uses.

Supply

During the war large quantities of L.P.G. were recovered in refineries for use in the production of aviation gasoline and synthetic-rubber components. Since the cessation of hostilities a large portion of the facilities producing aviation-gasoline components have been employed for other purposes. A very large quantity of the butane (and butylenes) formerly used for producing war materials is now going into motor fuel, however, a good portion of it has been made available for use by the L.P.G. industry. It appears that butane will continue to command a higher price than propane due to the demand for butane in motor fuel.

From available information it appears that most of the increased volume of L.P.G. marketed in 1946 over 1945 was obtained from refinery sources. Large additional quantities of L.P.G. are potentially available both from natural-gas sources and from refinery sources. With firmer prices for propane in the future it will be possible for producers to justify its diversion from other end uses and to invest in recovery and purification equipment to bring additional product to commercial specifications.

One of the greatest shortages encountered during the past year has been in transportation facilities. Because of limitations imposed during the war on the construction of new L.P.G. tank cars, the industry's fleet was taxed to capacity at the beginning of the war. The feverish attempts of the industry to enlarge this fleet have met with no success due to the shortage of steel and due to a program of constructing tank cars for ammonia to assist in a fertilizer-manufacturing program sponsored by the Government. An allocation of steel for a tank-car construction program has been approved by the Government and should help alleviate this shortage in 1947. There are approximately 3,400 tank cars transporting L.P.G. today, and there are about 2,300 new tank cars on order. The majority of these new cars have been on order for some time, and it is impossible now to say when their construction will be completed. Considerable effort has been devoted to stretching the movement of L.P.G. in truck transports to assist in overcoming the tank-car shortage.

To overcome the inherent burden on the industry's facilities to cope with the winter requirements an increasing demand prevails for the installation of larger-volume storage capacity at all points in the distribution channels.

New Developments

The use of L.P.G. for the cultivation and preservation of agricultural products has shown a healthy increase. Flame weeding passed from the development stage to that of successful commercial application. L.P.G. is finding use in the many new dehydration plants. The experimental use of flame to promote the culture and ripening of products is continuing and the results appear promising.

The growing demand for the use of L.P.G. in foreign countries was keenly evident throughout the year. Some petroleum companies having international organizations are now more aggressively developing these markets.

The demand for long distance transportation of L.P.G. in large quantities has accelerated plans for barge and tankship design and construction.

Magnolia Announces New Wage Plan

DALLAS.—A further adjustment in pay to meet living-cost increases has been offered employes of Magnolia Petroleum Co. and Magnolia Pipe Line Co. in an announcement by J. L. Latimer, president of the two companies.

The announcement said:

"The company, after having given consideration to the matter, has reviewed the whole question of living cost adjustment, taking into consideration living-cost increases that have developed since October 1, 1946, and will now make a further adjustment in the income of substantially all employes to the effect that incomes be increased 12½ per cent of the gross earnings for the period October 1, 1946, to September 30, 1947, minus, of course, the 1 week's payment that has heretofore been made and provided that no amount paid to any employe under this plan exceeds $75 per month."

In a letter to employes, Latimer said the living-cost allowance of 1 week's pay, announced by the company November 15, had been paid all employes. The announcement also said:

"As indicated in the letter sent the employes, the whole question of living-cost adjustment from October 1, 1946, has been taken into consideration by the company, and the offer is made to employes covered by labor-union contracts with the expressed provision that such labor unions, in their acceptance of the proposal, abate any further claims against the companies for wage increases during the period October 1, 1946, to September 30, 1947. The intention, of course, is to arrest the spiraling movement of wages in the petroleum industry and give stability to the employes' incomes for the period indicated."

October Crude Imports Drop 44,000 Bbl. Daily

WASHINGTON.—Imports of crude oil in October dropped to 231,000 bbl. daily from a September daily average of 275,000 bbl. Cumulative total for the first 10 months of 1946, however, showed imports running well ahead of petroleum imports during the same period in 1945.

Exports, still feeling the effect of the maritime strike, fell to 290,000 bbl. daily against 352,000 bbl. daily in September, according to the monthly foreign-trade summary of the U. S. Bureau of Census.

IMPORTS (1,000 Bbl.)

	Oct.	Daily ave.	Sept.	Daily ave.
Crude oil	7,149	231	8,255	275
Gas and fuel oil	4,053	131	4,815	161

EXPORTS (1,000 Bbl.)

Crude oil	4,622	149	3,687	123
Gas and fuel oil	1,440	46	2,722	91
Motor fuel and gasoline	1,942	63	3,240	108
Lubricating oil	998	32	896	30

Industry Names National Oil and Gas Committee

An advisory committee to the oil and gas industry, composed of 25 representatives of the major petroleum and natural gas associations, was organized recently and laid plans for appointment of subcommittees to study legislation, practices, and activities affecting the industry.

The committee elected Joseph W. Bowes, president, Oklahoma Natural Gas Co., Tulsa, and B. A. Hardey, independent producer, Shreveport, La., cochairmen. It includes five representatives each from the American Petroleum Institute, Independent Petroleum Association of America, American Gas Association, Independent Natural Gas Association of America, and Mid-Continent Oil and Gas Association.

The group named Dallas, Tex., as committee headquarters and voted to hold a second meeting prior to January 10.

A.P.I. Group to Study Stand on Co-op Taxes

NEW YORK.—To determine what steps the American Petroleum Institute will take, if any, on the tax exemptions enjoyed by cooperative oil organizations in the United States, an 11-man committee has been named with John C. Case, Socony-Vacuum Oil Co., Inc., as chairman.

The committee will report to the A.P.I.'s board of directors. Other members are: J. E. Dyer, Sinclair Refining Co.; S. B. Eckert, Sun Oil Co.; G. M. Gile, Gulf Oil Corp.; B. I. Graves, Tide Water Associated Oil Co.; Edwin S. Hall, Standard Oil Co. of New Jersey; A. Jacobsen, Amerada Petroleum Corp.; George Krieger, Ethyl Corp.; B. L. Majewski, Deep Rock Oil Co.; Henry Porter, Standard Oil Co. (Ind.); and R. L. Saunders, The Texas Co.

Tanker Sales Total 91

WASHINGTON.—Sale of a total of 47 surplus tankers to American operators and 44 tankers for foreign registry had been approved by the U. S. Maritime Commission by the end of November under the Merchant Ship Sales Act of 1946.

In announcing approval of the sales, the commission announced that two 523-ft. tankers damaged in a collision last year, the Hat Creek and Battle Mountain, both of 141,000-bbl. capacity, will be offered for sale at a minimum price of $250,000 each.

Meeting Told Oil Taxes In "State of Uncertainty"

SAN ANTONIO. — Outlines of tax policies and practices of state governments in the Mid-Continent area with emphasis on their application to the petroleum industry held the attention of 175 oil men attending the Mid-Continent Oil & Gas Association's annual ad valorem tax forum here last week.

The visitors heard Jack M. Campbell, executive secretary of the New Mexico Oil and Gas Association, declare during the 3-day meeting that while the general tax program is sound, the taxation of oil and gas properties "is in a state of uncertainty." He cautioned visiting oil men to "make certain that we have a part in such future trends as may develop."

H. W. Pryor, head of state and local tax department, Arkansas Fuel Oil Co., Shreveport, La., was elected chairman for 1947, succeeding Marshall L. Edwards, Skelly Oil Co., Tulsa. Pryor was succeeded as vice chairman by H. F. Harrington, tax agent, The Texas Co., Houston.

Three veteran tax specialists in the petroleum industry were presented distinguished service awards during the forum. They are: George W. Davis, Shell Oil Co., Inc., Tulsa; J. A. Prickett, Magnolia Petroleum Co., Dallas; and George W. Foster, The Texas Co., Houston.

Forum attendants voted to hold their next meeting in Jackson, Miss., in the autumn of 1947. Dates of the forum are expected to be announced early next year.

Texas Freight-Rate Hike Hearing to Be January 2

AUSTIN. — The Texas Railroad Commission January 2 will hear the applications of Texas common-carrier railroads for an increase of 20 per cent in most freight rates and charges for intrastate shipments.

The railroads are seeking to apply to intrastate freight the same increases in rates on interstate freight authorized by the Interstate Commerce Commission December 5.

Smith Replaces Olds As FPC Chairman

WASHINGTON.—Leland Olds has resigned as chairman of Federal Power Commission which has elected Nelson Lee Smith to succeed him.

A commission announcement said Olds, a member since 1939 and chairman since 1940, had asked to be relieved of the responsibility. The commission also elected Richard Sachse vice chairman.

Imminent Freight-Rate Increase Boosts Products-Market Activity

TANK-CAR movement of petroleum products was reported extremely heavy because of the approach of the January 1 effective date of the higher freight rates authorized earlier this month by the Interstate Commerce Commission.

In the Mid-Continent area, orders for material in advance of the higher railroad tariffs were further strengthening an already tight market, particularly in burning oils. One market source said "everybody is loading up, provided they can get a car to move it in."

Tank cars were in such demand some market transactions were made contingent on their availability. Slower tank-car movement since the end of the war, aggravated by the recent coal shortage, was a source of complaint in many sales offices.

With the heavy movement of products before freight-rate deadline, some observers expected a minor slump in market activity after the first of the year. However, this possibility was considered remote in view of the likelihood of cold winter weather which would intensify burning-oil demand.

Gasoline continued strong for this time of the year. Contract material was moving at prices ranging upward from 7 cents, though some spot-market motor fuel was available as low as 6½ cents.

The entire range of burning oils was showing increasing strength. One marketer, pointing out that demand will be even heavier over the next few months, remarked that "we may have been lucky to have had mild autumn weather."

Another price increase in the distillate group was considered a possibility. Sales of some grades at ⅛ cent above the posted market low were reported by marketers.

Another feature of market activity was residual fuel oil. Some residual was said to be moving at $1.39 per barrel with the buyer furnishing tank cars. Industrial buyers were making offers for Mid-Continent heavy fuel oil, most of which goes to railroads at $1.25 per barrel under contract arrangements.

Two optimistic forecasts last week contributed to a bullish outlook in trade circles. One was the Interstate Oil Compact Commission's economics-advisory committee report predicting an over-all 3 per cent rise in demand for all oils in 1947. The others was the Bureau of Mines forecast for a 4 per cent gain in products demand next year.

Natural gasoline was quoted at 4½ cents North Texas and 5 to 5⅛ cents in Oklahoma. The current quotations wiped out an abnormal spread of ⅝ to ¾ cent between prices in the two areas. Demand for the light 26-70 grade was still strong; several suppliers were not quoting.

Lubricating-oil prices in the Mid-Continent area pushed up to fractionally higher levels. Refiners' quotations were 17 cents for 200 vis. No. 3 neutral, and 26.5 to 34 cents for 150-160 vs. D, 10 to 25 p.p. bright stock. Little lubricating oil was available to any but regular buyers.

The monthly tabulation of service-station gasoline prices throughout the country reflected higher refinery prices and increased dealer margins. December 1 prices in 50 cities averaged 21.70 cents, with the service station price, exclusive of tax, at 15.61 cents—up 0.09 cent. The Bureau of Census in Washington reported filling-station sales in November were 18 per cent over November 1945 but down 3 per cent from October 1946.

Appalachian Crude Prices And Subsidies Clarified

PITTSBURGH.—An erroneous impression currently exists in the Appalachian area as to the mount of subsidy which is added to the posted prices of oil produced in the various districts. Originally, a subsidy of 75 cents was added to each posted price, but as increases were made in various districts and not general increases and as the federal agencies ruled that any increase in posted prices would be automatically deducted from the subsidy, the final result, including December 1 general increase of 14 cents, is as listed:

District—	Posted price	Subsidy added	Total paid
Bradford - Allegany	$3.55	.30	$3.85
Southwest Pa.	3.34	.16	3.50
Eureka (W. Va.) ..	3.34	.10	3.44
Buckeye (Ohio)....	3.30	.10	3.40
Zanesville (Ohio)..	3.00	.10	3.10

Sohio Division to Move

CLEVELAND.—The accounting division of Sohio Petroleum Co., which handles production for Standard Oil Co. (Ohio) will be moved to Oklahoma City shortly after January 1. Sohio recently created two major divisions in the south, one at Oklahoma City and the other at Houston.

Trans-Continental Renews Gas Pipe-Line Application

WASHINGTON. — Trans-Continental Gas Pipe Line Co., Inc., of Longview, Tex., has applied to the Federal Power Commission for authorization to construct a 26-in. natural-gas pipe line 1,380 miles long from Hemphill, Tex., to New York, at an estimated cost of $130,000,000.

The application, filed by Claude A. Williams of Austin, Tex., president, is an amendment to an application filed March 1, 1946, asking authority to operate the big-inch and little big-inch pipe lines in gas service. The new application states the company has contracts to purchase and sell 325,000,000 cu. ft. per day, much of it gas now wasted in production of oil in East Texas and the Gulf Coast. Sales contracts have been made with gas-distributing companies in Baltimore; Philadelphia; Wilmington, Del.; Elizabeth and Newark, N. J.; New York, and Brooklyn, the application said.

DEATHS

Joseph J. Strekfus, 56, former oil operator, died December 16 at his home in Mercedes, Tex.

Jim E. Young, drilling superintendent for Argo Oil Corp., died December 16 in an airplane crash at Marfa, Tex. His home was in Russell, Kans.

Amos W. Standing, 86, manager of Houston Oil Co. until his retirement in 1932, died December 16 at his home in Houston.

Joseph A. Goodson, geologist for Pure Oil Co., Olney, Ill., his wife and their two children died December 9 in the fire which destroyed the Winecoff Hotel in Atlanta, Ga.

Thomas W. Morrow, Jr., 51, consulting gas engineer, died December 20 at his home in Tulsa. He was owner of Oklahoma Meter & Gas Testing Co. and vice president of Hoil Engineering Corp.

William C. Tompsett, 78, independent producer in western Pennsylvania, died December 15 at his home in Tidioute.

Jay Elmer Ward, 58, drilling superintendent for Kendall Refining Co. at Derrick City, Pa., died December 19 in a Bradford, Pa., hospital. He had been with Kendall for 25 years.

WASHINGTON WATCHING

BY HENRY D. RALPH

Penn-Grade Crude Subsidy

WASHINGTON.—The stripper-well subsidy program has now been officially abandoned except for a maximum of 40 cents per barrel for Pennsylvania-grade crude.

A directive to the Reconstruction Finance Corporation from the office of Temporary Controls notes that since June the price of crude oil has gone up more than the amount of the subsidy at that time, except for Penn grade, so the subsidy has automatically terminated and now is formally wiped off the books.

Last June the Penn-grade subsidy was 75 cents, and RFC is now directed to reduce this by the amount by which the posted price exceeds the June 30 OPA ceiling price, or by 35 cents, whichever is larger. The directive is so worded that further Penn-grade price increases will mean corresponding reductions in the subsidy.

I.P.A.A. on Import Duties

NOT content with opposing reduction of import taxes on petroleum products, the Independent Petroleum Association of America asks that all previous duty cuts on both crude petroleum and petroleum products be rescinded and the original rates restored, that there be assurance that the rates will not be reduced in the future, and that import quotas be established to make sure that future imports are limited to amounts needed for consumption beyond the ability of domestic fields to produce under good conservation practices.

The petition was filed last week with the Committee for Reciprocity Information in connection with the forthcoming negotiation of reciprocal-trade agreements with 18 foreign nations. Hearings on all the commodities subject to reduction will be held during January and February.

Increased import duties and a restrictive quota are legally possible, it is argued by Russell B. Brown, I.P.A.A.'s general counsel, because of safeguard provisions in the Reciprocal-Tariff Act and the "escape clause" in the Venezuelan and Mexican agreements which reduced the taxes below the rates set by Congress. He also charged that the State Department, by ignoring protests of domestic producers, has failed to keep its promise of "constant and careful supervision" of reciprocal-trade agreements to prevent injury to domestic industry.

Citing statistics to show that imports of petroleum are much higher and exports lower than before the war, the brief declares that a further duty cut will injure independent producers, cause premature abandonment of stripper wells, interfere with conservation and secondary-recovery projects, reduce oil-industry wages, injure the local economics of oil-producing areas, and promote monopoly or concentration of business in those large American companies which produce most of the oil in other countries. It declares that increased petroleum imports are not needed, since domestic productive capacity is ample to supply all internal demands.

Oil-Tariff Digests

STATISTICAL digests of tariff information on all petroleum items listed for possible duty cuts in the forthcoming 18-nation trade agreement negotiations are now available for the asking from the U. S. Tariff Commission.

The digests consist of 10 sheets, covering 10 products, showing production, imports, and exports, by quantity and value, for the years 1937, 1938, 1939, and 1943, with imports broken down by principal supplying countries and by the nations asking for concessions. There is also a brief description of each commodity classification and information about the tariff history and current import tax.

The commodities covered are liquid petroleum asphalt, gasoline and naphtha, kerosene, gas oil and distillate fuel oil, residual fuel oil, unfinished oils, topped crude petroleum, lubricating oil, paraffin and paraffin wax, and medicinal mineral oil.

Davies Steps Down

HIGH praise for Ralph K. Davies, retiring from the Government after 5½ years of service, was given by Secretary of the Interior J. A. Krug in accepting Davies' resignation as acting director of the Oil and Gas Division.

The secretary also indicated his full support for the Oil and Gas Division and the National Petroleum Council by saying that they should help solve the problems of oil during peace as these problems were handled during the war.

Davies' resignation was chiefly a review of the origin and purposes of the OGD, carrying the expressed hope that other agencies of the Government will cooperate to make it the oil policy-coordinating body and channel for communication between the Government and the industry. He offered his services in assisting the department with this program and also in support of the Anglo-American oil treaty.

Davies said he had no plans for the immediate future except to enjoy a long vacation at his home in Woodside, Calif. His successor, Max W. Ball, has already taken over as director of the division.

A Merger for Geologists

SHIFTS within the Interior Department have now been accomplished whereby the Geological Survey has taken over all exploration work formerly conducted by the Bureau of Mines, while Mines will concentrate on engineering as distinguished from geology.

The chief transfer was the former division of geophysical exploration of the bureau which has now been consolidated with the survey's section of geophysics. H. R. Joesting of the survey is geophysicist-in-charge of the consolidated section. F. W. Lee, chief of the former Bureau of Mines geophysical work, will henceforth devote his time to a special program of research in instrumentation.

The merger of the two geophysical research groups will permit greater and more effective utilization of latest geophysical techniques by the Geological Survey in its expanding program of mineral exploration, as well as in its related programs involving investigations in the fields of structural, stratigraphic, engineering, and economic geology.

Further redefinition of functions between the survey and the bureau is under way in accordance with a program of Secretary Krug to eliminate duplication and overlapping within the department.

Container Regulations

THE National Petroleum Association has requested Interstate Commerce Commission to suspend a regulation issued by eastern railroads requiring use of a heavier type of fiber carton for shipping packaged lubricating oils and similar products.

The petition, filed by Harry S. Elkins, N.P.A. traffic attorney, asks ICC to investigate need for the new regulation before permitting it to go into

effect, saying that the experience of refiners with the present carton does not indicate that it is responsible for damages in shipment nor that heavier types are required. It declares that the new cartons not only will cost from 7 to 30 per cent more, but that materials are so short that manufacturers will have to reduce their output by 10 per cent to meet the new specifications and that many refiners will be without shipping containers during the changeover. It also complains that western and southern railroads have not made similar changes in their shipping requirements, so that carton specifications would not be uniform and eastern refiners would be at a competitive disadvantage.

Synthetic-Rubber Review

ELEVEN AND ONE-HALF months after the close of the year the Reconstruction Finance Corp. has issued a detailed review of its rubber program during 1945.

Except for historical reference, its chief interest now is the comparison between forecast and actuality. At the end of 1945 RFC was closing its synthetic-rubber plants rapidly, because the administration economists figured we were heading smack into a depression and the demand for rubber would go way down. Synthetic production dropped below 50,000 tons per month and a maximum of 40,000 was predicted as the 1946 demand. But before long RFC had to reopen some of the plants, and synthetic production was up to 70,000 tons per month by midyear.

Again this fall the administration took a dim view of things to come, so RFC was ordered to curtail again. A couple of months ago an output of about 95,000 tons of synthetic rubber was the goal for the first quarter of 1947, so production was tapered off to a little more than 50,000 tons per month. Now it seems evident that the first quarter will see a demand for at least 150,000 tons.

However, RFC has permanently closed down its alcohol-butadiene plants, though this necessitated reopening two of its smaller but more efficient butylene butadiene plants in Texas. A number of copolymer plants are scheduled for closing in the near future.

One happy feature of the curtailment program is that the smaller the production of synthetic rubber the lower the cost per pound produced. This is because the higher-cost plants are closed as demand falls off, while the other plants are kept operating at their greatest efficiency. This process of lower costs with less production can go on until output gets down to an annual rate of around 300,000 tons, which is about one-third of our total rubber consumption and the figure generally used as the probable peacetime ratio of synthetic to natural rubber.

This fact suggests that synthetic rubber will always be able to compete with natural on a price basis, though RFC doesn't like to talk much about costs because there are too many variables and intangibles. Butadiene costs have gone up this fall as crude petroleum prices rose, and the price of soap, a major item in copolymerization, is skyrocketing. However, these cost increases have been just about balanced by closing the high-cost plants, so that the average price of synthetic rubber has remained about the same, and RFC officials are confident they can keep costs at the present level or below as further high-cost plants are taken out of the program.

Texas High Court Refuses Hawkins Field Case Review

AUSTIN.—The Texas Supreme Court this week refused to review a suit by Humble Oil & Refining Co. against the Texas Railroad Commission for a greater share in oil production from Hawkins field of East Texas.

Humble's complaint about the commission's allocation of production resulted in several long hearings and final suit. The company complained that it was not allowed a share of production proportionate to its acreage. The alleged discrimination was in favor of "town-lot" leases. Company estimates were that the difference in its share of the production would amount to $30,000,000.

Refusal to review the case was with the notation that no reversible error was found in the decision of the Third Court of Civil Appeals. Such a notation means that the Supreme Court does not necessarily endorse or adopt all parts of the opinion of the lower court. In this case, the opinion has announced the theory that the commission has a right to consider economic cost of development in allocating production of an oil field. Economic development cost is greater to a small operator than one operating on a large scale, it was said.

Imperial to Place U. S. Tankers in Service

TORONTO, Ont.—Four tankers, recently purchased from the U. S. Maritime Commission, will shortly be placed in commission by Imperial Oil, Ltd. The first of these, Imperial Quebec, will be the fastest tanker ever owned in Canada, with a speed of 14.5 knots and capacity of 145,000 bbl. With the other ships, Imperial Toronto, Imperial Edmonton, and Imperial Winnipeg, replacing the four tankers lost during the war, she will operate between Canada and ports in the United States and South America.

Cement-Industry Fuel Consumption Increases

Fuel-oil consumption in the cement industry was 36 per cent higher in October than in the same month of 1945, according to a survey by the Bureau of Mines. Natural-gas consumption was 24 per cent greater for the same period.

The portland-cement industry used 350,394 bbl. of fuel oil in October this year, compared with 257,394 bbl. in 1945, and 5,387,789 M.c.f. of natural gas, against 4,351,765 M.c.f. in 1945 Coal consumption showed a gain of 60 per cent over the previous October.

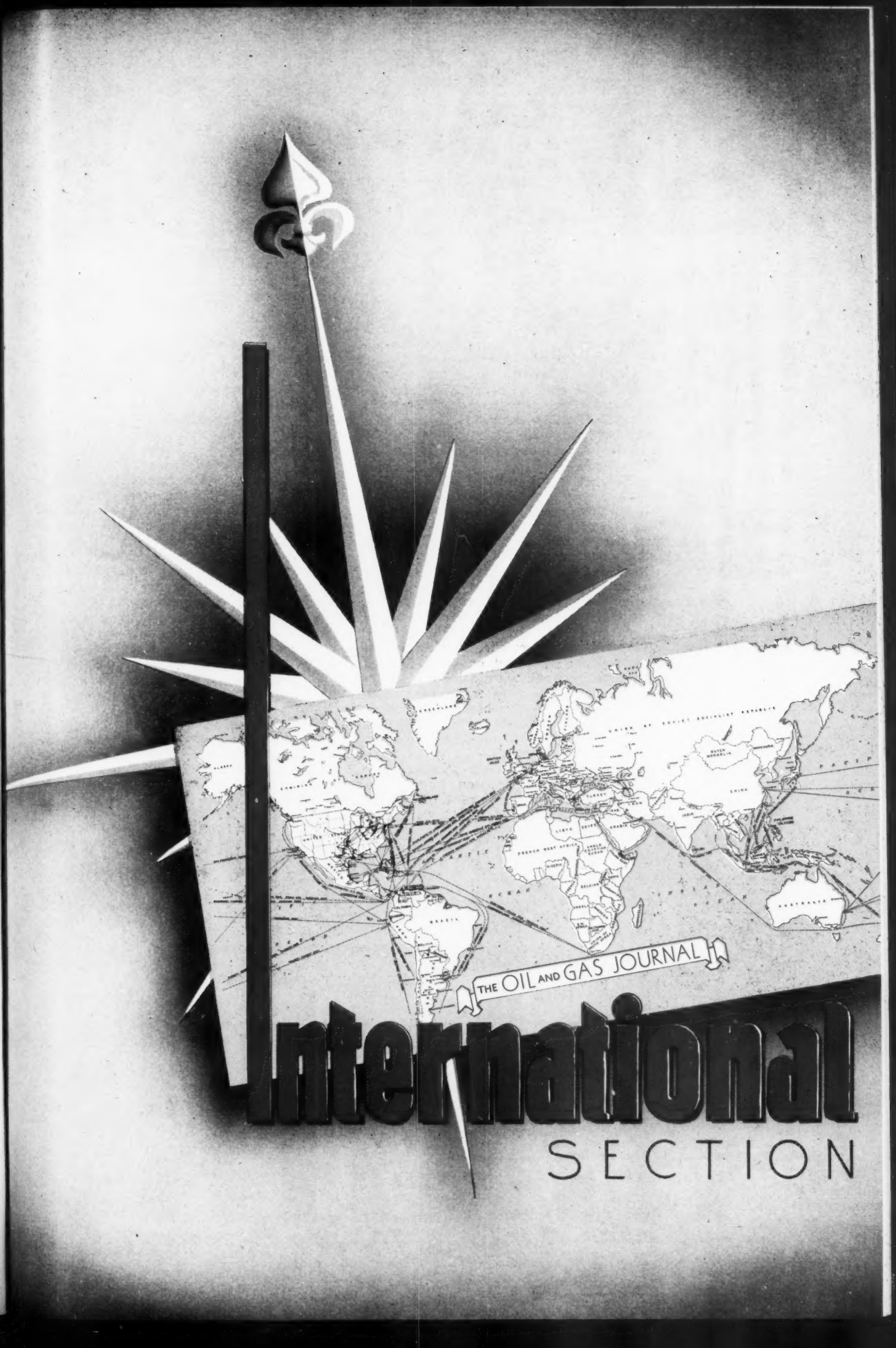
Texas Underproduction Averages 7.73 Per Cent

AUSTIN.—Production of crude oil in Texas during the first 10 months of 1946 totaled 630,108,421 bbl., according to figures compiled by the Texas Railroad Commission. The output represents an underproduction of 7.73 per cent.

The cumulative allowable for Texas fields from January 1 to October 31 was 681,148,087 bbl. Allowable for leases not reporting their production was 1,138,707 bbl., and over production was 2,778,776 bbl., leaving an underproduction figure of 52,679,735 bbl. for the period.

INTERNATIONAL SECTION — *Starts on next page*

This section of the Journal is devoted to world oil operations outside the United States, and includes a world survey of oil fields and refineries. In addition, a principal feature of the issue is the four-color-process Journal-Guide to World Oil, included as a 36-in. by 48-in. insert map. This map affords the reader a streamlined encyclopedia of international oil.


THE OIL AND GAS JOURNAL
International
SECTION

WORLD OIL

AS 1946 draws to a close and 1947 prospects are appraised, it is obvious that the wartime forecasts of the petroleum requirements of a world in transition from war to peace, were too pessimistic. In late 1944 and during all the period of 1945 when the end of the war could be seen coming, many estimates of the probable postwar demand and supply situation were made by various authorities. Almost without exception, these forecasts indicated a readjustment period in which the current supply of petroleum and its products would greatly exceed the consuming ability of the civilian industry.

It is now apparent that petroleum has assumed a new and far more important place in the economy of practically every nation in the world.

World-wide shortage of coal resulted in substitution of fuel oil on a huge scale. The wreckage of railroad and inland waterway transportation systems demanded new methods of transport, and outside the United States, the peoples of the world turned to truck and bus transport on a scale never previously approached in most of these countries. The seemingly enormous amount of military transport vehicles and vessels was quickly absorbed in the task of getting the wheels of civilian industry and distribution turning again.

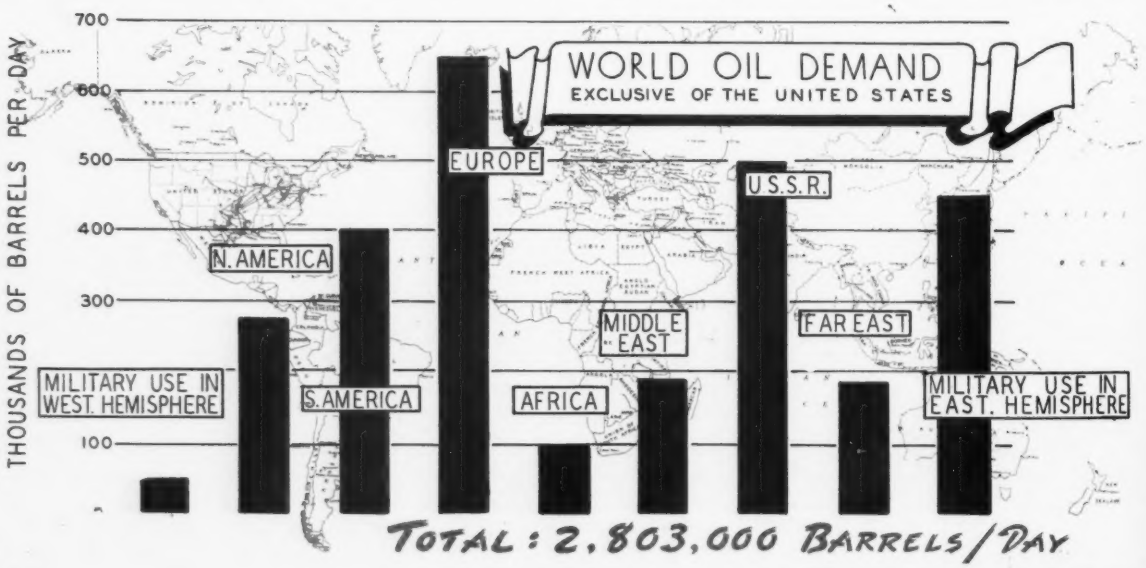
Direct military consumption has not decreased as fast as anticipated. In this connection, it is interesting to note that in the table of estimated world demand outside the United States for 1947, a total of 700,000 bbl. daily is set up for direct U. S.-British military demand.

It is now possible to appraise the 1947 prospects from a better perspective, after nearly a year and a half of postwar reconstruction. This picture is optimistic. Never before have governments, industries, and peoples been so conscious of the importance of petroleum and its products. Never before has there been such a realization of the benefits that can be obtained from the use of petroleum, and the progress that it makes possible in raising living standards.

In the prewar period, petroleum products were considered luxuries in many parts of the world outside the United States. As luxuries, there was a constant pressure by many governments to limit their consumption. In spite of this the world curve of petroleum demand moved up at a steep rate year after year. In the postwar world, this curve of demand is obviously entering an entirely new phase. Future increases outside the United States, it is believed, will be much greater and will come much faster than any projection of the prewar demand curve would indicate.

Meanwhile, expansion of the crude-oil supply outside the United States proceeds rapidly to meet the increased demands. This expansion of foreign supplies appears safe, since an oil-hungry world will probably absorb these as fast as they can be developed.

By CHARLES J. DEEGAN and WARREN W. BURNS



OPERATIONS

AT RECORD LEVELS

Moreover, foreign countries possessing crude-oil resources are anxious to have them developed. Since it appears probable that investments in this foreign development can be made without endangering their large investments in U. S. properties, many American oil companies are entering the foreign field on a large scale. The prospects of the more important areas are briefly summarized in the following paragraphs.

The world's crude-oil producing potential at the end of the first full year of peace is, in round figures, 8 million barrels per day. The actual production falls somewhat shy of that, due to the fact that war damage has not been restored completely in the fields of Europe, Russia, the East Indies, and Asia.

The present production is somewhere around 7¾ million barrels daily, a little over or a little under, depending on how far above or below the ½-million daily mark the Russian production now stands. No official information is yet available on the U.S.S.R.

Of this production potential, 60 per cent is in the United States, the remainder divided around the rest of the world. Taking the rest of the world as a unit, of its potential 3,200,000 bbl. daily crude production, 42 per cent or 1,345,000 bbl. in round figures, comes from the Caribbean Sea area of North, Central, and South America, almost all from Mexico, Colombia, Venezuela, and the Island of Trinidad. Venezuela, with 1,100,000 bbl. out of the 1,345,000 bbl., completely overshadows all other countries in this region. Venezuela is still firmly in second place among the world's oil-producing countries.

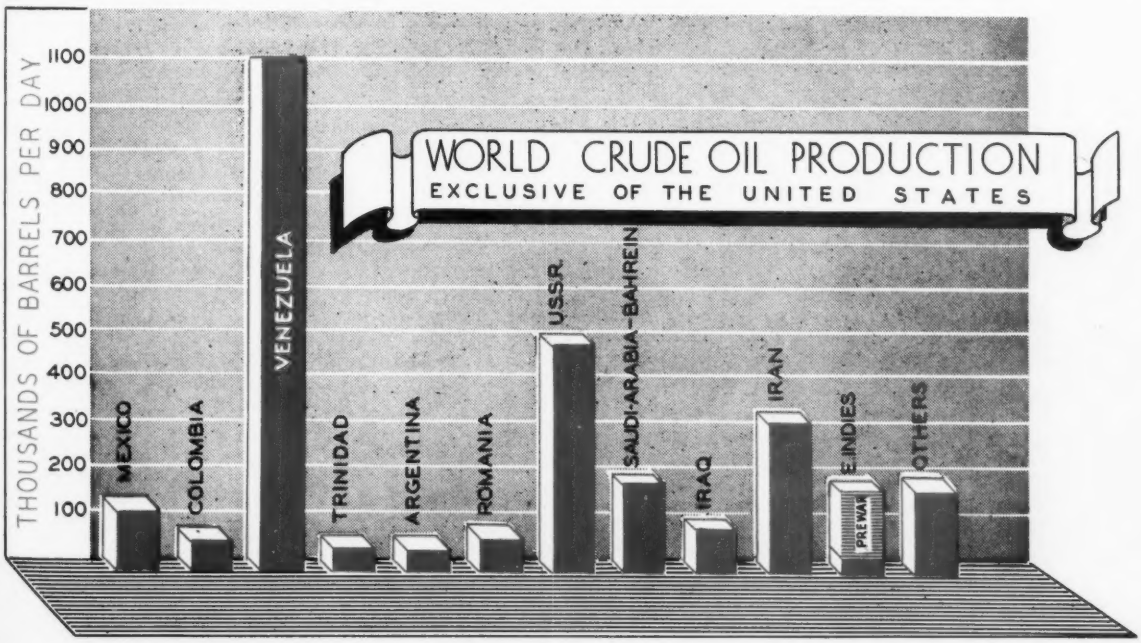
The next largest concentration of production is in the Middle East, or Persian Gulf area, Iran, Iraq, Saudi Arabia, Bahrein Island, Kuwait, Qatar, and for convenience, include the small production in Egypt. Here, 770,000 bbl. daily accounts for 24 per cent of the production outside the United States.

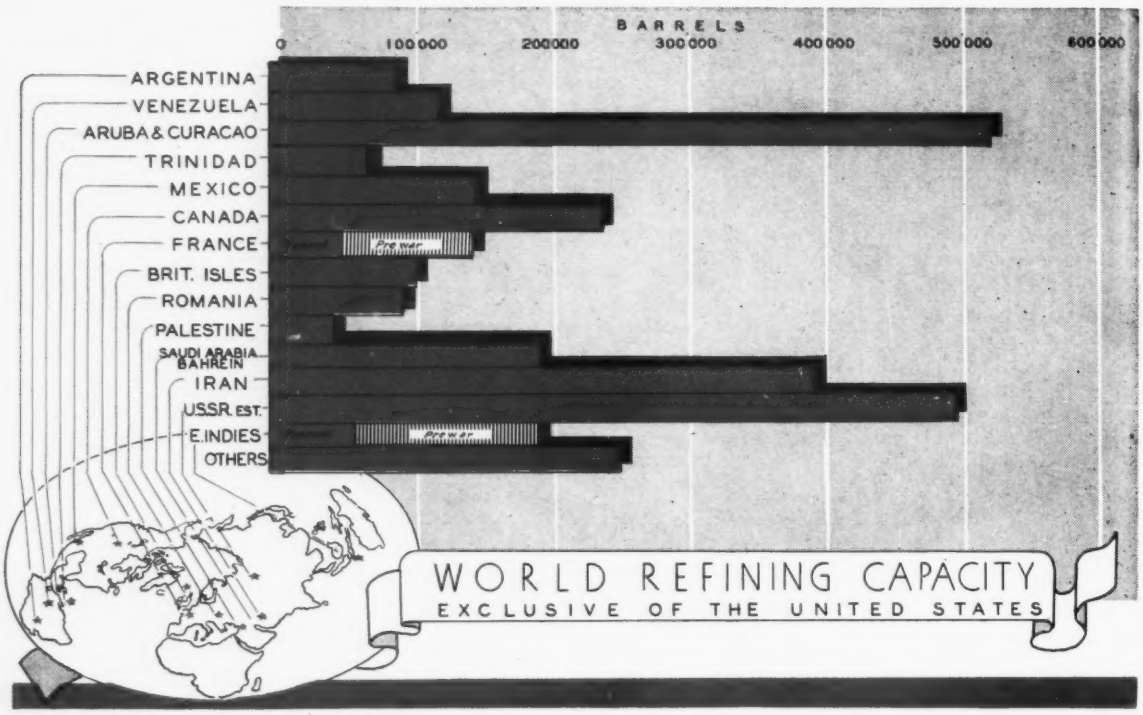
If Russia's production is estimated at the midpoint of 500,000 bbl. between varying current reports that range from 450,000 to 550,000 bbl. daily, another 16 per cent of the nondomestic production is accounted for.

Thus with 42 per cent for the Caribbean area, 24 per cent for the Middle East, and 16 per cent for Russia, all other areas combined account for only 18 per cent of the potential current world production outside the United States. Of this remainder, restoration work in Russia, the East Indies and Romania will take up a large portion.

Caribbean Area

Of all the countries in the Caribbean area, only Trinidad has had a real intensive exploration, and there are





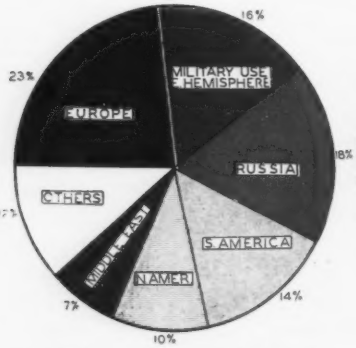
two schools of thought on that area. Of the others, Mexico since expropriation, and in the uneasy period prior to that event, has certainly had no modern, large-scale exploration play using the latest techniques of geophysics and geology. Most geologists consider Mexico, outside of a few spots, like the Tampico area, comparatively unexplored as far as oil is concerned.

Colombia is just entering the first stages of a real exploration and development campaign. Exploration in Colombia in the past has been hampered by a complicated legal framework, which has been partially simplified in recent years. Development is slow, because the terrain of the country is such that transportation outlets call for large investments that can only be justified after millions of barrels of proven reserves are in sight. The future prospects are excellent, but there are still difficulties that hamper rapid development.

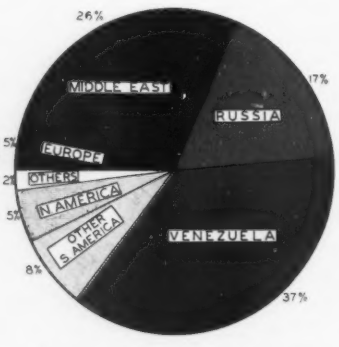
Venezuela got a rapid start with development of oil in the Maracaibo Basin, reasonably close to water transportation. The basin's oil potentialities are still great, in spite of the amount of development and exploration work already done. The basin alone is currently producing a little more oil than the Middle East, and expansion is still the order of the day.

But even as the basin achieves this dominant position in world oil production outside the United States, the drilling activity in Eastern Venezuela is exceeding that of the basin. Over half the current drilling in the country is in the eastern part, although that part only accounts for one-third the current production. Obviously then, in the future, a larger and larger portion of the country's production is going to come from the eastern part.

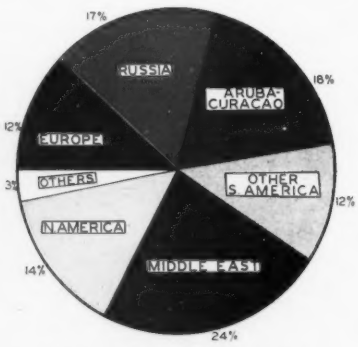
With bright prospects for continued expansion in the Maracaibo Basin, yet with the major portion of the attention being paid to the eastern part of the country, Venezuela appears to be headed for a higher and higher rate of production. Moreover, the richness of the fields found, and the estimates of proven reserves, made on



WORLD OIL DEMAND
EXCLUSIVE OF THE UNITED STATES
2 803 000 BARRELS DAILY



CRUDE PRODUCTION
EXCLUSIVE OF THE UNITED STATES
2 930 000 BARRELS DAILY



REFINING CAPACITY
EXCLUSIVE OF THE UNITED STATES
2 981 000 BARRELS DAILY

the most conservative basis, indicate that this higher rate of production can be sustained for many years.

No discussion of this Caribbean area would be complete without at least a reference to the firm conviction of the geologists that, in the shallow sea areas along the continental shelf adjacent to these countries, much greater potential reserves of oil are awaiting the drill, than all that will ever be found on the land areas.

Europe

The bulk of the crude-oil production in Europe is found in areas associated with the Carpathian Mountain system, and therefore in countries in which the U.S.S.R. is endeavoring to establish its sphere of influence most strongly. Romania, Austria, and Hungary account for the bulk of Europe's production, as nearly as the current boundary situation permits allocation by countries. These countries account for 120,000 bbl. of the 142,000 bbl. daily production now set up as the total for Europe.

Middle East

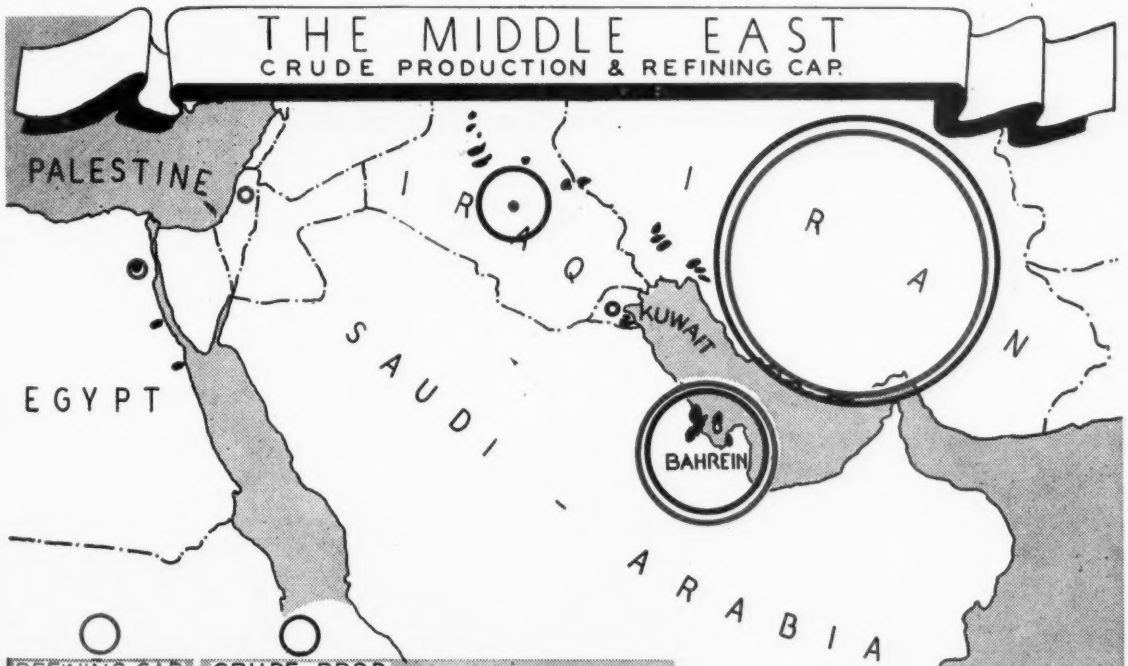
The cycle of war events brought the Middle East into the oil picture very rapidly and the results are permanent. Enormous fields, from which millions and hundreds of millions of barrels of oil can be and are being produced from a very few wells, mark this as one of the richest petroliferous regions that has ever been found. From the standpoint of exploration, it has scarcely been scratched.

There was little change in Middle East production and refinery operations from the final months of World War II over the past year except in Saudi Arabia and Kuwait. At the close of the year Saudi Arabian crude-oil output had increased to approximately 200,000 bbl. daily from three fields in contrast to the 75,000 bbl. daily production from one field at the close of 1945.

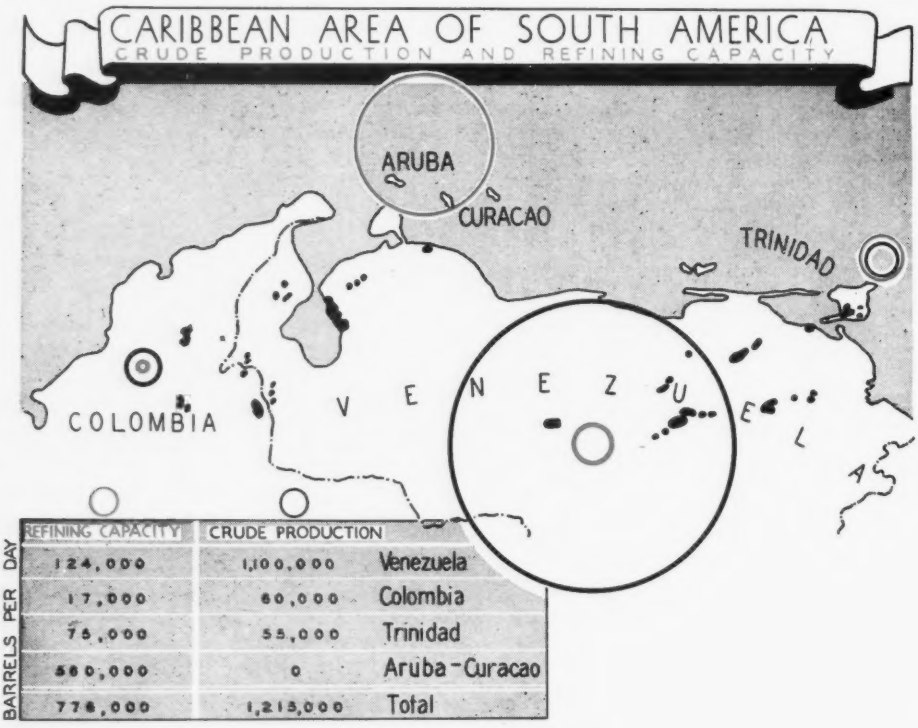
Outstanding in Saudi Arabia has been the performance of the wells in the Abqaiq field which is located 50 miles southwest of Dammam, the discovery field and the site of the main operating camp at Dhahran. The first well was completed in 1941 and five wells were completed successfully before the field activities were shut down due to war conditions. A pipe-line outlet was provided early this year and a total of 10 wells have been drilled. The field which has not been outlined in any direction is now credited with a minimum reserve of 3 billion barrels.

Arabian American Oil Co., operator of the Saudi Arabian properties, is jointly owned by Standard Oil Co. of New Jersey and The Texas Co. which are also the joint owners of Bahrein Petroleum Co., Ltd., which has an oil field and refinery on the adjoining island of Bahrein in the Persian Gulf. The two operations have a crude-oil production at this time of about 225,000 bbl. daily and a refinery output of 210,000 bbl. daily, an output which in the Eastern Hemisphere is second only to the Southwest Iran field and refinery operations of Anglo-Persian Oil Co., Ltd. In addition the Arabian American company is making tanker shipments to buyers in Argentina and Italy.

Of major importance not only in Saudi Arabia but the entire Middle East and the Eastern Hemisphere gen-

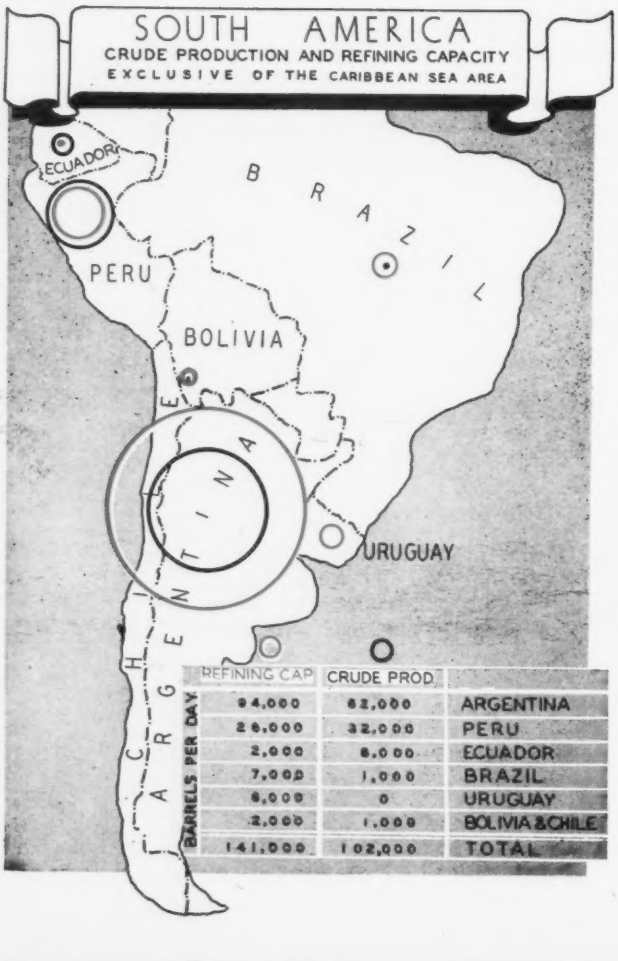


BARRELS PER DAY	REFINING CAP	CRUDE PROD.	
	402,000	422,000	IRAN
	200,000	198,000	SAUDI ARABIA - BAHREIN
	7,000	96 000	IRAQ
	63,000	0	PALESTINE
	0	30,000	KUWAIT
	35,000	26,000	EGYPT
	707,000	770,000	TOTAL



BARRELS PER DAY

REFINING CAPACITY	CRUDE PRODUCTION	
124,000	1,100,000	Venezuela
17,000	60,000	Colombia
75,000	55,000	Trinidad
560,000	0	Aruba-Curacao
776,000	1,215,000	Total



BARRELS PER DAY

REFINING CAP.	CRUDE PROD.	
84,000	62,000	ARGENTINA
26,000	32,000	PERU
2,000	6,000	ECUADOR
7,000	1,000	BRAZIL
8,000	0	URUGUAY
2,000	1,000	BOLIVIA & CHILE
141,000	102,000	TOTAL

erally was the announcement in mid-December that Standard Oil Co. of New Jersey and Socony-Vacuum Oil Co., Inc., were negotiating for the purchase of a substantial share in the Arabian American operations. If this purchase is consummated, it is believed that it will assure a further expansion in Saudi Arabian oil operations including the laying of a big-inch line from the fields to the Eastern Mediterranean, a project which has been under consideration as a company project since the close of World War II. It is believed that this development may result in other changes in Middle East oil operations.

The other major operating development of the year in the Middle East over the past year was the completion of a pipe line and terminal facilities for the loading of crude oil from the Burghan field in Kuwait. Deliveries now averaging 40,000 bbl. daily started in May.

U. S. S. R.

There is no official information available today that will permit any comprehensive survey of the current picture of the Russian oil industry. Quite possibly this is as much the result of the damage suffered by that country during the war, and the gigantic problems of reconstruction and restoration in all industry, as it is reluctance to publish data.

However, as piecemeal information does become available, it is significant that estimates of how much damage was done are on the increase, and estimates of the country's current productive and refining capacity are revised downward.

Certainly under normal conditions, Russia should be able to produce over 600,000 bbl. daily from productive areas proven before the war. Exploration work has been carried on in many parts of the Soviet Union and reports of favorable indica-

tions and of oil and gas discoveries in remote parts of that vast land mass have been published.

From our knowledge of the general geology of the country, there is no reason to doubt that many wildcat discoveries have indicated potential fields. Nor is there any reason why oil should not be found in quantity east of the Ural mountains in Asiatic Russia; nor why many fields should not be found and developed along the east side of the Caspian Sea.

Obviously the Russian petroleum industry, government controlled and operated in a country short of everything, will develop only as fast as the large amounts of equipment calling for foreign exchange can be purchased. Development of national manufacturing plants for various items of equipment will probably come gradually, but these also require outside capital equipment, available only by using foreign exchange.

Hence the future Russian oil production and refining picture is one that will be dependent, more than in any other country, on the government's over-all plans and the relative importance of petroleum in them.

East Indies

In the prewar period, this area had developed production of 180,000-200,000 bbl. daily, with relatively large areas scarcely scratched by large-scale exploration. Deliberate sabotage at the direction of the British and United States governments prior to the Japanese invasion, followed by Japanese reconstruction efforts, which were then subjected to aerial bombing, and then a final phase of sabotage by the Japanese as they were forced to relinquish their conquests, have left a confused mess. Even where fields have been relatively little damaged, restoration efforts are slowed down by lack of balance between production and transportation, shipping, and refining facilities.

The bulk of the production and refining capacity are in areas where the unsettled political problems involved in the new postwar relationship between the Netherlands and the nationals of the islands have prevented large-scale restoration.

Burma

The situation in Burma is similar to that in the East Indies. Little is known regarding the present status of operations. There was sabotage prior to the Japanese invasion, some restoration by the Japanese, and some aerial bombing damage. Now there is political unsettlement, and the latest information indicates that some 10 per cent of prewar normal production is being obtained, under the direct operating supervision of British military authorities.

ESTIMATED FOREIGN CRUDE OIL PRODUCTION AND DEMAND INDICATED CURRENT RATE—NOVEMBER 1946

	Thousands of bbl. daily	
	Crude oil production	Total demand*
Alaska		6
Canada	21.0	160
Mexico	129.0	92
Cuba	1.0	15
Total North America (outside U. S. A.)	151.0	273
Colombia	60.0	12
Trinidad	55.0	31
Venezuela and N.W.I.	1,100.0	113
Total Caribbean	1,215.0	156
Argentina	62.0	120
Peru	32.0	14
Other Latin America	8.0	112
Total other South America	102.0	246
Direct (U. S.-British) Military—West. Hemisphere		50
Total Western Hemisphere (excluding U. S. A.)	1,468.0	725
Austria	20.0	5
France	1.0	109
Germany (excluding Soviet Zone)	13.0	60
Great Britain	1.0	216
Hungary	15.0	32
Romania	85.0	23
Other Europe (excl. U.S.S.R. and Baltic States)	7.0	206
Total Europe (excl. U.S.S.R. and Baltic States)	142.0	650
Egypt	26.0	56
Iraq	96.0	5
Iran	422.0	77
Bahrein-Arabia	196.0	12
Kuwait	30.0	
Other Near and Middle East		41
Total Near and Middle East	770.0	191
North Africa (excluding Egypt)		41
West Africa		25
South and East Africa and Islands		33
Total Africa	0	99
China	1.0	24
India-Burma	9.0	62
Japan	4.0	19
Other East and South Asia	1.0	82
Total East and South Asia	15.0	187
N.E.I.—Borneo—New Guinea	35.0	1
Direct (U. S.-British) Military—East. Hemisphere		450
Total Eastern Hemisphere	992.0	1,578
Total Foreign (excl. U.S.S.R. and Baltic States)	2,430.0	2,303
U.S.S.R. (unofficial estimate)	500.0	1500
Total World (outside U. S. A.)	2,930.0	2,803

*Total demand includes internal consumption, "normal" or local military demand, bunkers, industry uses, refinery consumption and losses as well as direct military demand where indicated. †Probably more as Russia is importing crude oil from Soviet dominated Balkan countries, although much of the "plus" may be used for occupational military demand outside of Russia.

tank ships

Present world tonnage amounts to slightly more than 21½ million deadweight tons, as compared with some 13 million in September 1939. The U. S. alone has about 13½ million of this tonnage.

by Benedict Saurino*

DISPOSAL of surplus tankers is proceeding at snail's pace, and the Government's tied-up fleet, comprising more than one-quarter of the total world tank-ship fleet, is still one of the major question marks in the future tanker picture.

Another big question mark is the future of the big-inch pipe lines, for with these lines in use, approximately 60 to 66 T-2 type tankers would be replaced.

Since the end of the war, world tanker-fleet capacity has increased 1.6 per cent, but radical changes in distribution of tanker ownership among nations has occurred. One of the most significant factors in this change is the sharp reduction in fleets of the defeated Axis powers, and the consequent increase in fleets of various victorious countries.

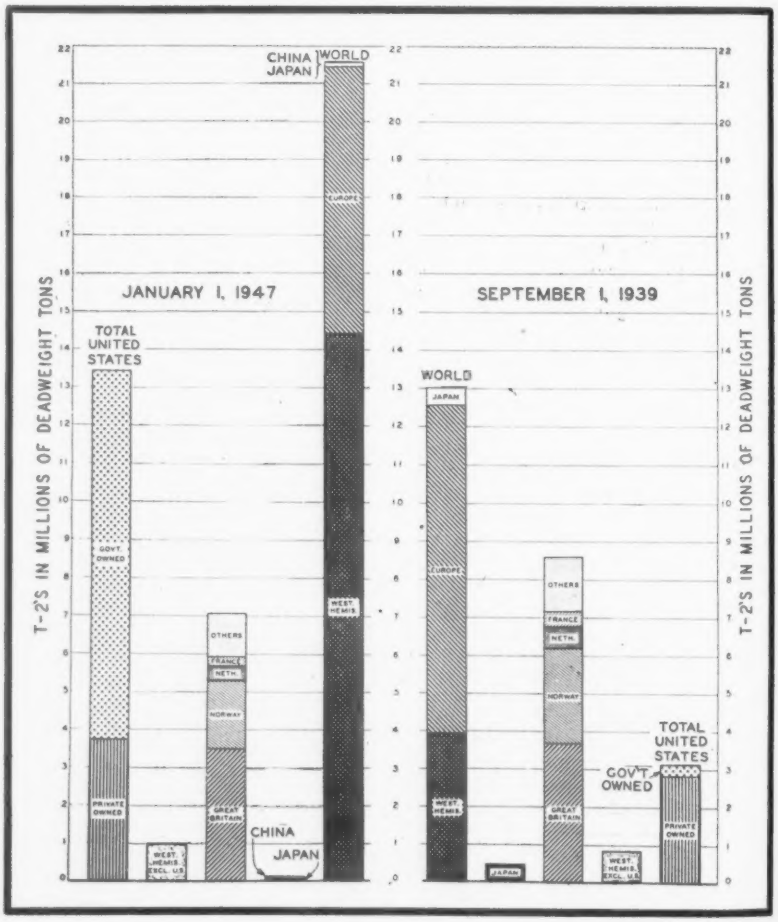
In Table 1 there is an estimate of world fleets by flag ownership as of January 1, 1947. Information appearing in this tabulation was obtained from data contained in the United States Maritime Commission files effective in September 1946 and estimated for the last quarter. Privately owned vessels under the United States flag reflect the individual operators' reports concerning their fleet and include their contemplated changes during the last quarter of 1946.

World fleet capacity increased 66 per cent during the war. Since the end of the war, major changes have occurred primarily in the United States and British fleets. In a previous study presented to the special Senate committee investigating petroleum resources it was shown that on September 1, 1945, the United States owned 59.8 per cent of the world tonnage while today that proportion has increased to 62.3 per cent. This compares with 23.9 per cent owned by the United States on September 1, 1939. Great Britain has increased her relative position from 15.1 per cent on September 1, 1945, to 16.2 per cent currently and is within 5 per cent of her prewar carrying capacity.

Severe losses were suffered during the war not only by Great Britain but also by Norway, the Netherlands, and France. While the United States has a carrying capacity some 4.32 times its prewar level and Great Britain has now reached 95 per cent of its former tonnage, Norway, the Netherlands, and France have only 72 per cent, 68 per cent, and 63 per cent, respectively, of their prewar fleet capacities.

A considerable proportion of the gains in the tanker fleets of victorious countries since the end of the

Fig. 1—World tank-ship fleets in T-2 equivalents, January 1, 1947, and September 1, 1939. (Ocean-going vessels 2,000 gross tons and over)



*Manager, Statistical Research Division, Sun Oil Co.

war can be accounted for by a review of the changes in fleets of the defeated Axis powers. Germany, Italy, and Japan had, according to the best estimates available at the end of the war, a total of 1,198,700 deadweight tons on a T-2 basis. Currently, their fleet has been reduced to approximately 263,200 deadweight tons. Of this total, 103,900 deadweight or 39 per cent is registered under the Italian flag. Tankers registered under the German flag now represent approximately 95,600 deadweight tons on a T-2 basis which is 23 per cent of its fleet on September 1, 1945. Informed estimates of Japan's fleet on September 1, 1945, showed 658,900 deadweight tons of T-2 equivalent capacities under that flag, while today there are registered 63,700 tons or less than 10 per cent of its tank-ship fleet at the end of the war.

On the basis of T-2 equivalent capacities and speed present world tonnage amounts to slightly more than 21.5 million deadweight tons. This compares with approximately 13 million on September 1, 1939, or an increase of 66 per cent. Shifts in fleet capacities when including transfers for lend-lease and other arrangements under the flags of actual ownership are shown in Fig. 1. The ratios mentioned above are readily illustrated in this chart. In 1939 the world fleet consisted of 13,003,000 deadweight tons on a T-2 capacity basis. Today, the United States alone has some 13,419,000 tons or 3 per cent more than the world fleets combined on September 1, 1939. Great Britain which in 1939 ranked first in ownership with 28.2 per cent of the world capacity now is in second place with 3,483,800 deadweight tons or 26 per cent of the United States' fleet. The largest single ownership rests in the United States Government's fleet which accounts for 9.7 million tons of T-2 equivalents or 45 per cent of the world capacity. Actually, these vessels amount to 684 in number, have slightly more than 10 million deadweight tons and a speed of approximately 14 knots. Most of them are of the T2-SE-A1 type even though many older vessels have been traded in for newer ships under the Ships Sales Act.

In appraising the ownership of world tank-ship fleets it is informative to note the construction programs existing at the beginning of 1947. Table 2 containing this information shows that of 118 vessels under construction or on order world-wide, a total of 95 are to be built in only three countries—52 in Great Britain, 11 in Denmark, and 32 in Sweden. Of the British construction program, 42 ships are to be built for their own account while Sweden is building the bulk of its orders for Norway. In total, 84 of the 118 vessels are being constructed for two countries and they are equally divided with 42 each for Great Britain and Norway. Only

TABLE 1—WORLD TANK-SHIP FLEETS BY FLAG AS OF JANUARY 1, 1947
(Ocean-going vessels 2,000 gross tons and over)

Flag—	January 1, 1947				T2-SE-A1 equivalent						
					Jan. 1, 1947		Sept. 1, 1939		% of world		Ratio
	No.	Gross tons	D.W.T.	Average speed	No.	D.W.T.	No.	D.W.T.	1-1-47	9-1-39	1-1-47 to 9-1-39
Western Hemisphere:											
United States	951	8,784,894	14,035,000	13.86	800.5	13,419,800	185.3	3,106,600	62.3	23.9	4.32:1
Private	267	2,471,791	3,985,100	13.54	221.9	3,720,100	167.9	2,814,900	17.3	21.7	1.32:1
Government	684	6,323,103	10,050,000	13.99	578.6	9,699,700	17.4	291,700	45.0	2.2	33.25:1
Panama	75	529,665	827,600	11.04	37.1	622,000	34.6	580,100	2.9	4.4	1.07:1
Others:											
Argentina	23	151,217	214,400	11.56	10.2	171,000	8.9	149,200	0.8	1.1	1.15:1
Brazil	5	30,183	44,000	10.21	1.8	30,200	0.5	8,400	0.1	0.1	3.59:1
Chile	2	7,586	9,600	11.00	0.4	6,700	0.4	6,700	0.0	0.1	1.00:1
Honduras	....	.....	.....	....	.....	.....	0.6	10,100	...	0.1	0.00:1
Mexico	13	81,080	125,700	10.38	5.4	90,500	0.7	11,700	0.4	0.1	7.74:1
Peru	1	2,820	4,300	10.00	0.2	3,300	0.2	3,400	0.0	...	1.00:1
Philippines	....	.....	.....	....	.....	.....	0.3	5,000	...	...	0.00:1
Uruguay	....	.....	.....	....	.....	.....	....	.....	...	...	...
Venezuela	22	63,483	87,600	9.97	3.6	60,400	3.6	60,300	0.3	0.5	1.09:1
Subtotal "others"	66	336,369	485,600	10.82	21.6	362,100	15.2	254,800	1.7	2.0	1.42:1
Total Western Hemisphere (excluding Canada, including Philippines)	1,092	9,650,928	15,348,300	13.61	859.2	14,403,900	235.1	3,941,500	66.9	30.3	3.65:1
Europe:											
Great Britain	421	3,036,413	4,447,900	11.36	207.8	3,483,800	218.9	3,669,900	16.2	28.2	0.95:1
Norway	174	1,450,237	2,197,500	11.98	108.3	1,815,600	150.9	2,529,800	8.4	19.5	0.72:1
Netherlands	72	362,850	508,900	10.93	23.0	385,600	33.9	568,300	1.8	4.4	0.68:1
France	25	194,079	289,800	11.56	13.8	231,400	22.0	368,800	1.1	2.8	0.63:1
U.S.S.R.	15	87,408	130,000	10.49	5.6	93,900	7.6	127,400	0.4	1.0	0.74:1
Germany	9	73,371	109,500	12.73	5.7	95,600	18.3	306,800	0.4	2.4	0.31:1
Italy	17	99,109	143,000	10.63	6.2	103,900	27.0	452,700	0.5	3.5	0.23:1
Sweden	39	343,906	524,700	13.20	28.5	477,800	12.7	212,900	2.2	1.6	2.24:1
Others:											
Belgium	6	45,767	68,900	11.06	3.1	52,000	4.8	80,500	0.3	0.6	0.65:1
Denmark	10	87,412	135,000	11.80	6.6	110,600	7.7	129,100	0.5	1.0	0.86:1
Finland	....	.....	.....	....	.....	.....	0.4	6,700	...	0.1	0.00:1
Greece	4	18,089	27,400	9.90	1.1	18,400	2.0	33,500	0.1	0.3	0.55:1
Portugal	4	24,991	37,600	11.18	1.7	28,500	0.1	1,700	0.1	...	16.76:1
Romania	....	.....	.....	....	.....	.....	1.0	16,800	...	0.1	0.00:1
Spain	22	129,117	181,400	11.90	8.9	149,200	4.8	80,400	0.7	0.6	1.86:1
Turkey	1	6,134	9,000	14.00	0.5	8,400	0.1	1,700	...	...	4.94:1
Yugoslavia	....	.....	.....	....	.....	.....	0.1	1,700	...	...	0.00:1
Subtotal "others"	47	311,510	459,300	11.58	21.9	367,100	21.0	352,100	1.7	2.7	1.04:1
Total Europe	819	5,958,883	8,810,600	11.61	420.8	7,054,700	512.3	8,588,700	32.7	66.1	0.82:1
Japan	10	52,676	74,000	12.59	3.8	63,700	28.2	472,800	0.3	3.6	0.13:1
China	4	30,475	46,000	10.00	1.3	21,800	.....	.....	0.1	...	.....
Total world fleet	1,925	15,692,962	24,278,900	12.87	1,285.1	21,544,100	775.6	13,003,000	100.0	100.0	1.66:1

Source: U. S. Maritime Commission, Division of Miscellaneous Economics and Statistics.

two tankers are currently under construction or on order in the United States. One of these is of 12,800 deadweight tons for Gulf Oil Corp. while the other is for the account of National Bulk Carriers, Inc., and is under construction at Welding Shipyards, Inc. This vessel promises to be the largest tank ship ever constructed, its specifications being 582 ft. 6 in. in length between perpendiculars, 80-ft. beam, 43 ft. 9 in. in depth, and a rated speed of 16 knots. With a deadweight of approximately 27,000 tons, its cargo capacity would range between 200,000 and 235,000 bbl. Ships under construction worldwide would represent about 45 per cent of the United States privately owned fleets.

In Table 3, there is contained a summary of privately owned vessels under the United States flag. In their order of magnitude, it will be noted that the five largest owners rank as follows: Standard Oil Co. (N.J.), Gulf Oil Corp., Socony-Vacuum Oil Co., Inc., The Texas Co., and National Bulk Carriers, Inc. The total privately owned fleet has 14 per cent more capacity today than it had at the end of the war. This is due to transfers of old vessels and purchases of larger and faster ships. It will be seen that since the end of the war the net difference in number amounted to an increase of only six tankers while

TABLE 2—TOTAL TANK SHIPS UNDER CONSTRUCTION AND/OR ON ORDER BY COUNTRIES AS OF JANUARY 1, 1947
(Ocean-going vessels 2,000 gross tons and over) Source: U. S. Maritime Commission

	Total			For own flag			For other flags								
							Norway			France			Netherlands		
Under construction in—	No.	Gross tons	D.W.T.	No.	Gross tons	D.W.T.	No.	Gross tons	D.W.T.	No.	Gross tons	D.W.T.	No.	Gross tons	D.W.T.
United States	2	24,450	39,800	2	24,450	39,800	..	.....	.....	..	.....	.....	..	.....	.....
Great Britain	52	409,511	655,218	42	358 641	573 826	7	36,500	58,400	..	.....	.....	3	14,370	22,992
Belgium	1	8,700	13,920	1	8,700	13,920	..	.....	.....	..	.....	.....	..	.....	.....
Denmark	11	122,600	196,160	..	.....	.....	7	82,600	132,160	4	40,000	64,000	..	.....	.....
France	7	67,843	108,548	7	67,843	108,548	..	.....	.....	..	.....	.....	..	.....	.....
Italy	8	52,325	83,720	8	52.325	83,720	..	.....	.....	..	.....	.....	..	.....	.....
Spain	4	32,362	51,779	4	32,362	51,779	..	.....	.....	..	.....	.....	..	.....	.....
Sweden	32	342,400	547,200	4	40 000	64,000	28	302,400	483,200	..	.....	.....	..	.....	.....
Norway	1	5,100	7,620	1	5,100	7,620	..	.....	.....	..	.....	.....	..	.....	.....
Total	118	1,065,291	1,703,965	69	589,421	943,213	42	421,500	673,760	4	40,000	64,000	3	14,370	22,992

Not available for U.S.S.R., Japan or Germany.

TABLE 3—UNITED STATES PRIVATELY OWNED TANK SHIP FLEET AS OF JANUARY 1, 1947
(Ocean-going vessels 2,000 gross tons and over)

Owner—		Weighted average speed		T2-SE-A1 equivalent			
Oil-company owned:	No.	(knots)	Gross tons	D.W.T.	No.	D.W.T.	% of total
Atlantic Refining Co.	13	13.97	136,927	221,700	12.7	212,900	5.7
Cities Service Oil Co.	6	13.55	54,564	87,600	4.9	82,100	2.2
Continental Steamship Co.	3	13 03	25.070	40.200	2.2	36,900	1.0
Gulf Oil Corp.	29	12.54	255,000	408 000	21.0	352.100	9.5
Pan American Petroleum & Transport Co.	6	13.70	50.981	85.100	4.8	80 500	2.2
American Oil Co.	2	13.00	19,854	31,000	1.7	28,500	0.8
Pure Oil Co.	3	13.08	20 826	33 000	1.8	30.:00	0.8
Sabine Transportation Co.	5	10.46	28,226	47,100	2.0	33.500	0.9
Richfield Oil Corp.	3	13.66	25.062	40,600	2.3	38.600	1.0
Sinclair Refining Co.	13	13.87	112,098	174,600	10.0	167.700	4.5
Socony-Vacuum Oil Co., Inc.	20	13.91	197,751	323.000	18.5	310.200	8.3
Standard Oil Co. of California	12	13.50	100,986	155.200	8.6	144,200	3.9
Standard Oil Co. (New Jersey)	51	13.80	503,473	823,400	46.8	784.600	21.2
Sun Oil Co.	11	13.58	104,104	164.200	9.2	154.200	4.1
Motor Tank Ship Corp.	6	11.40	54,267	87,800	4.1	68,700	1.8
The Texas Co.	23	13.47	205.104	321.900	17.8	298.400	8.0
Tide Water Associated Oil Co.	11	12.27	100,617	160.800	8.1	137.800	3.7
Union Oil Co. of California	7	13.40	63,852	101,500	5.6	93,900	2.5
Nonoil-company owned:							
Alpha Corp.	1	10.00	5,771	9.300	0.4	6,700	0.2
American Trading & Production Corp.	2	13.33	19,158	30.700	1.7	28.500	0.8
Barber Asphalt Co.	3	14.50	30,711	50,000	3.0	50.000	1.3
Bernuth, Lembcke Co., Inc.	3	11.12	19,304	31,200	1.4	23,500	0.6
Commercial Molasses Corp.	1	10.00	5,030	8,100	0.3	5,000	0.1
Durange Steamship Corp.	1	10.00	6,986	10.700	0.5	8,400	0.2
Grosvenor-Dale Co., Inc.	2	10.00	16,412	24,600	1.0	16.800	0.5
Hillcone Steamship Co.	3	12.52	20,279	31.700	1.7	28.500	0.8
Keystone Shipping Co.	6	14.78	61,202	100.100	6.0	100.100	2.7
Kurz, Charles & Co.	2	14.50	20,624	33.500	2.0	33.500	0 9
National Bulk Carriers, Inc.	13	15.64	146,309	247.600	15.9	267.500	7.2
Paco Tankers, Inc.	5	14.50	51,647	83.600	5.0	83.600	2.2
Tanker Sag Harbor Corp.	1	14.00	10,296	16,300	0.9	15,100	0.4
January 1, 1947, total private	267	13.54	2,471,791	3.985.100	221.9	3.720.100	100.0
Oil	224	13.38	2,058.062	3,307,700	182.1	3,052,900	82.1
Nonoil	43	14.29	413,729	677,400	39.8	667,200	17.9
September 1, 1945, total private	261	12.96	.....	3.651.219	194.6	3.262.500	100.0
Oil	208	12.85	.....	2,923,675	154.6	2,591,900	79.4
Nonoil	53	13.38	.....	727,544	40.0	670,000	20.6
January 1, 1947, as a per cent of September 1, 1945, total private	102.3	104.5	.....	109.1	114.0	114 0	....
Oil	107.7	104.1	.....	113.1	117.8	117.8	....
Nonoil	81.1	106.8	.....	93.1	99.5	99.5	....

Source: United States private owners and operators.

deadweight tonnage is approximately 334,000 tons greater and average speed is 13.54 knots compared with 12.96 knots.

On a T-2 basis this increase in the privately owned fleet amounts to 457,600 deadweight tons. Surprisingly, the nonoil company group of tank ships is faster than those owned by oil companies. This factor of greater speed coupled with a higher average deadweight tonnage for nonoil company ships explains the relative positional change of these companies. At the end of the war they had 20.6 per cent of the privately owned United States fleet. Actually, their fleet has decreased by 10 ships since September 1, 1945, but the change in T-2 equivalent capacity has been lowered by only 3,400 deadweight tons. Their position on a capacity basis is now 0.5 per cent less than at the end of the war. During this same period of time, oil company fleets have increased 17.8 per cent based on comparable capacity and speed.

In view of the significant ownership changes in the world tank-ship fleets during the war it seems appropriate to review tanker charter rates. Fluctuations in rates for the United States Gulf to North Atlantic movement are shown in Table 4 and Fig. 2. Using a simple average rate for clean and dirty tonnage it is noted that, historically, rates are subject to sharp and severe changes. In the period from 1928 to 1946 there were three peaks in the rate structure, namely, 1929, 1937, and beginning in 1940, throughout the war period. Average rates per barrel were 32.78 cents in 1929, 38.15 cents in 1937, and in 1941 just before war began they reached a high point of 47.65 cents per barrel on the average. For the first 3 war years they were stabilized by govern-

(Continued on page 227)

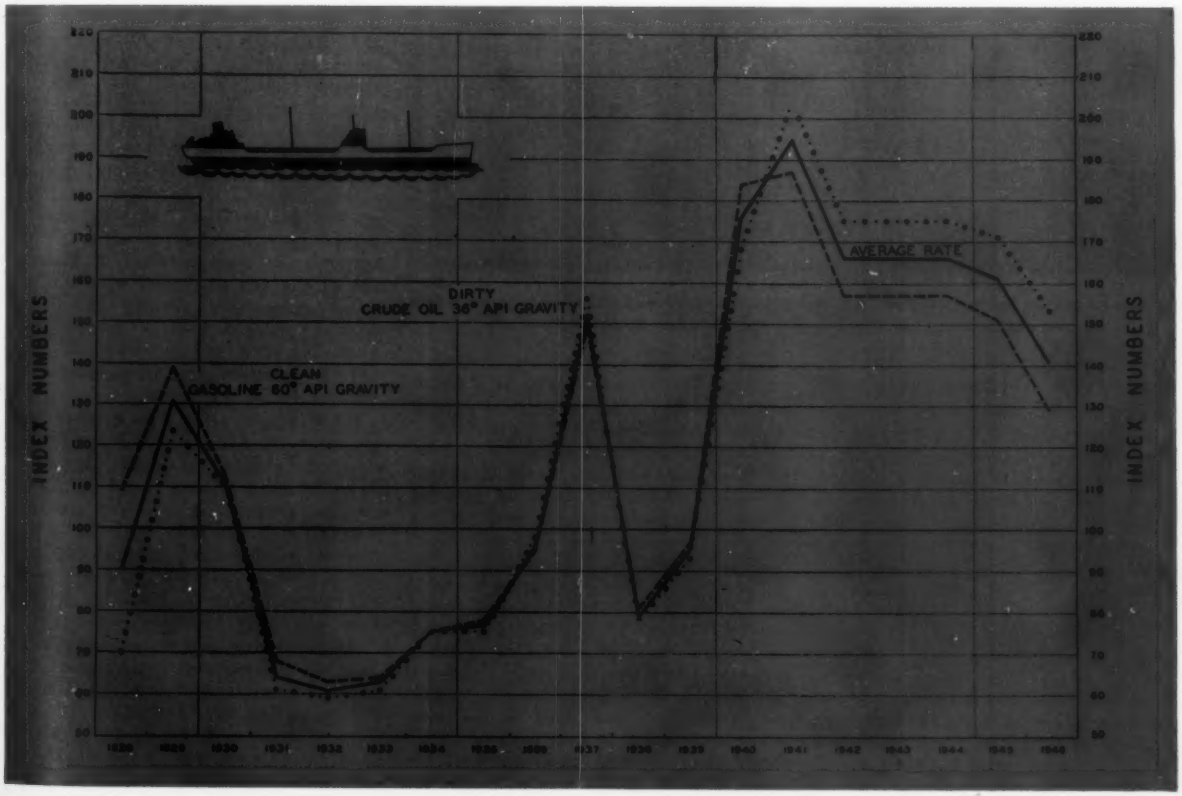
TABLE 4—AVERAGE TANKER CHARTER RATES FOR CLEAN AND DIRTY TONNAGE FROM UNITED STATES GULF TO NORTH ATLANTIC PORTS, ANNUALLY FROM 1928 TO 1946

(Rates in cents per barrel)

Year	Tanker charter rates — Actual — Dirty* (crude oil 36° A.P.I. gravity)	Actual — Clean* (gasoline 60° A.P.I. gravity)	Actual — Simple average†	Index, 1935-1939 = 100 — Dirty* (crude oil 36° A.P.I. gravity)	Index, 1935-1939 = 100 — Clean* (gasoline 60° A.P.I. gravity)	Index, 1935-1939 = 100 — Simple average†
1928	17.16	27.90	22.53	70	109	90
1929	30.05	35.50	32.78	123	139	131
1930	26.91	28.82	27.87	110	113	111
1931	14.83	17.38	16.11	61	68	64
1932	14.38	16.14	15.26	59	63	61
1933	15.07	16.25	15.66	61	64	63
1934	18.33	19.27	18.80	75	75	75
1935	18.48	19.91	19.20	75	78	77
1936	23.92	24.38	24.15	98	95	96
1937	28.35	37.95	38.15	156	149	152
1938	19.12	20.64	19.88	78	81	79
1939	22.69	24.83	23.76	93	97	95
1940	41.20	47.02	44.11	168	184	176
1941	50.06	47.64	48.85	204	187	195
1942	43.00	40.00	41.50	175	157	166
1943	43.00	40.00	41.50	175	157	166
1944	43.00	40.00	41.50	175	157	166
1945	41.87	38.52	40.20	171	151	161
1946	37.59	32.87	35.23	153	129	141

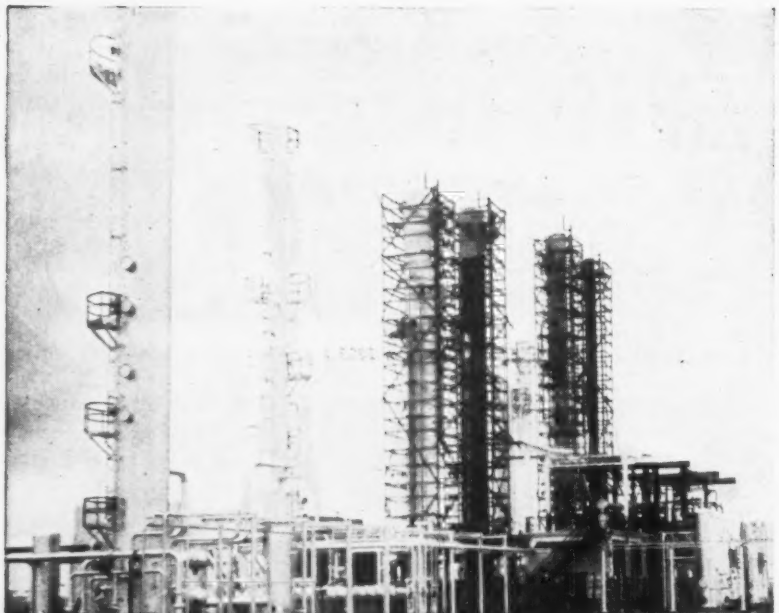
Source: 1928-1941—D. B. Dearborn & Co. 1942-1946—WSA rate schedules.
*Barrels per ton: 36° A.P.I. gravity crude, 7.582; 60° A.P.I. gravity gasoline, 8.670.
†Assumed on basis of equal clean and dirty cargoes carried.

Fig. 2—Index of tanker charter rates, United States Gulf to North Atlantic ports, 1928 to 1946. (1935-39 = 100)



Compania Consolidada de Petroleo's Pressure Maintenance and Gasoline Absorption Plant in Santa Barbara Field, Venezuela

by H. M. Russell and Earnest Moncrief†*



The new $4,000,000 "oil recovery and gasoline plant" actually is a combination of multi-duty units. Here are the crude-topping and gasoline fractionators

COMPANIA CONSOLIDADA DE PETROLEO, subsidiary of Venezuelan Petroleum Co., a Sinclair Oil Corp. affiliate, has recently placed in operation its new pressure-maintenance and natural-gasoline plant on its Meyer "C" Concession, Santa Barbara field, State of Monagas, Venezuela. The cost of the completed plant is approximately $4,000,000.

The primary functions of this plant are the return of gas to the oil-producing reservoirs, and the manufacture of natural gasoline and other liquid hydrocarbons. A crude-oil stabilization plant, a topping still, and a cut-oil treating plant, are also parts of the installation, as well as a water system and treater, electrical generating station, and steam plant.

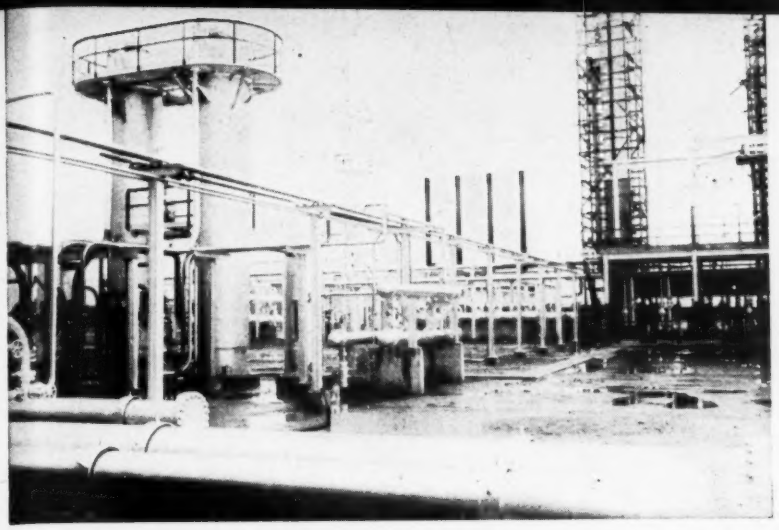
The Santa Barbara field is a part of the Jusepin-Mulata-Santa Barbara-Travieso producing area of Eastern Venezuela. The discovery well on the Meyer "C" concession was completed in March 1941, and as of September 1, 1946, 121 producing oil wells and 2 gas wells had been completed, some of which have, or will, become injection wells. A 12-in. pipe line, approximately 100 miles in length, connects the producing concessions of Consolidada in the area with a deep-sea loading terminal at Puerto de la Cruz, both being owned and operated by Consolidada. Production is from various sand zones of Miocene age, ranging in depth from 3,500 to 6,500 ft. The structure is a rather steeply, south-dipping monocline cut by numerous faults, the major ones being strike faults with production terminated to the north in part by a major fault of considerable displacement, and partly by up-dip termination of producing sands. To August 1, 1946, the Meyer "C" concession had produced approximately 24,500,000 bbl. Gravity of the oil ranges from 25° to 35°, the mixed stream being 31°-32°. Although discovery was made early in 1941, the first oil was not shipped until August 1943, due to lack of tankers during the war.

From the start of active production, company engineers gave careful study to the reservoir to determine gas-oil ratios, bottom-hole pressures, and reservoir performance under various producing conditions, in order to determine the best method of making use of the gas produced with the oil. After exhaustive studies and tests, it was decided that a combination plant for both gas injection and liquid-hydrocarbon recovery would be applicable to this field.

PAW approval of this project was obtained in January 1945, and construction started as soon thereafter as materials and men could be placed on the ground. Actual construction started in June 1945, and the plant placed in operation about September 1, 1946. A number of delays were experienced due to inability to obtain deliveries of materials.

All designing and engineering were handled by various branches of the Sinclair organization in the United States with the exception of the process area and dehydration plant. This entire area was designed, fabricated, and purchased f.a.s. U. S. port.

*Vice president, Venezuelan Petroleum Co. †Fluor Corp., Ltd.



The two solid-desiccant (Al_2O_3) dehydrator units in left foreground will handle 25,000,000 cu. ft. per day

under contract to Fluor Corp., Ltd., of Los Angeles. Construction was handled by company personnel, supplemented by available location contractors.

General Operation

Wet gas is brought to the plant from oil-and-gas separator stations in the field at approximately 50 lb. separator pressure where the gas is processed and dry absorber residue gas returned to the producing formations at 2,100 to 2,400 lb. pressure. The crude oil from these same separator stations passes through a crude-oil stabilizing tower where it is subjected to approximately 15 in. of vacuum which removes the undesirable fractions and is then piped to the main-line pump station. During the passage of this crude through the plant, propane, free natural gasoline is blended into the crude stream. This results in a stabilized crude having a vapor pressure of approximately 5½ lb. It is interesting to note that the crude as handled through this closed system is slightly higher in gravity after stabilization than it was when it was handled through open field tanks. This gravity increase is without benefit of the natural gasoline which is blended into the stream.

Pressure-Maintenance Plant

The pressure-maintenance plant consists of one vacuum and six three-stage six-cylinder angle-type compressors of 600 hp. each, and has a daily capacity of 21,000,000 cu. ft. of gas. Each compressor unit is equipped with 13, 8½ and 5-in. cylinders to handle a volume at 40-50 psig. suction and 1,800-2,500 lb. discharge. The one vacuum unit has 13½, 17, and 22-in. cylinders designed for 10-15 in. vacuum and 200 lb. discharge.

The 50-lb. field-separator wet gas, upon entering the compressor plant, is raised to 200 lb. at which pressure it passes through the gas coolers to the process area. Residue gas from the process area is picked up by the 8½-in. cylinders and discharged at 750 lb. through gas coolers to the dehydration plant. From there, it is picked up again by the 5-in. cylinders at 745 lb. and discharged into the high-pressure field system at 1,800 to 2,400 lb., the differential being dependent upon the ability of individual wells to take gas. Injection, at the present time, is into 13 wells, volumes running 13,500,000 cu. ft. Three other wells are scheduled to become injection wells at an early date and approximately 16,500,000 cu. ft. of gas will be returned to the reservoir.

Engineering data indicate that this gas injection should prolong the flowing life of the field, and result in additional ultimate recovery of oil, and conserve the gas for future operations.

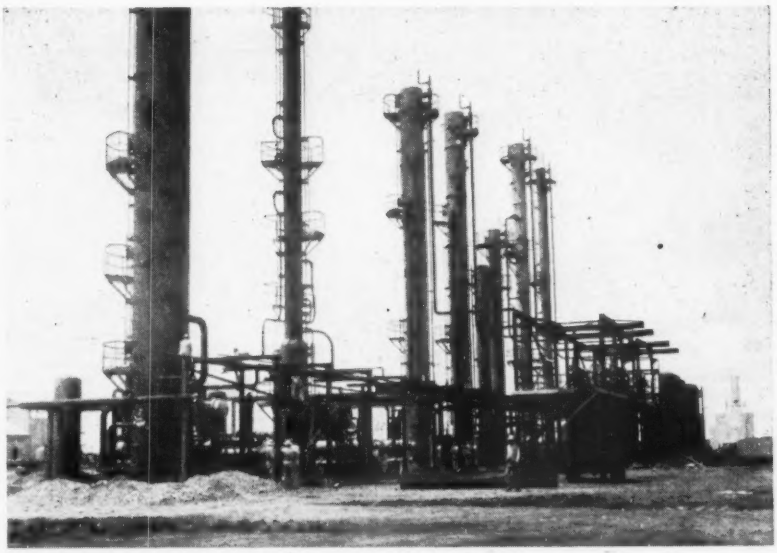
Gasoline plant.—A complete gasoline plant is installed on the discharge of the second stage of the compressor plant. This plant is designed to treat approximately 25,000,000 cu. ft. per day of natural gas extracting 30 per cent propane, 91 per cent isobutane, 97 per cent n-butane, together with substantially 100 per cent of the isopentane and heavier constituents which are in the untreated gas. Fractionating facilities are provided to produce natural gasoline and liquefied petroleum gas or propane.

Gas from the second stage intercoolers (See Fig. 1) enters the absorber at approximately 200 lb. and 95° F. where it is contacted with lean oil and the desired hydrocarbon constituents are removed from the gas. The treated gas from the top of the absorber goes to the third-stage compressor suction.

Rich oil from the bottom of the absorber is flashed into the reabsorber which operates at approximately 150 lb. The gas which is released from the rich oil by this pressure reduction, together with the noncondensable portion of the flash tower over head, is contacted with lean oil. The treated gas from the top of the reabsorber passes into the boiler-fuel system.

Rich oil from the bottom of the reabsorber is pumped through lean oil-rich oil heat exchangers, a steam-heated preheater, and into the flash tower which operates at approximately 175 lb. Substantially all the propane and lighter fractions are stripped from the rich oil in this column.

The partially stripped rich-oil pressures from the bottom of the flash tower through a preheater and into the still which operates at approximately 50 lb. All the remaining dissolved hydrocarbon constituents are



Another view of crude and gasoline fractionators. Motor gasoline, kerosene and absorption oil are made at the plant

Modified Flow Diagram of Santa Barbara Gasoline Plant

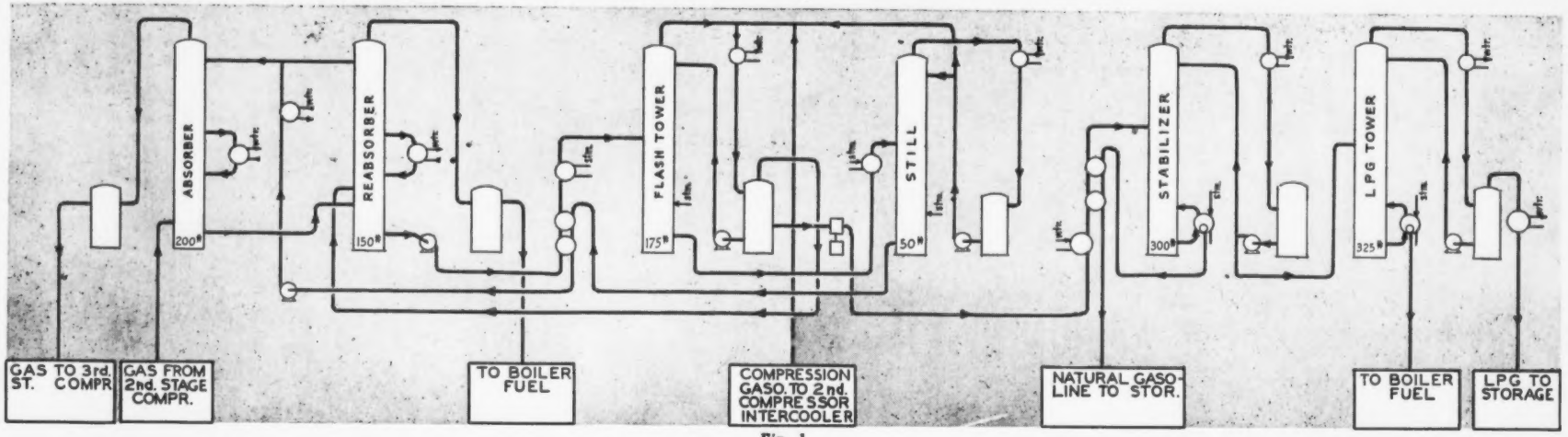


Fig. 1

Modified Flow Diagrams of Crude Unit, and . . . . . Dehydration Plant

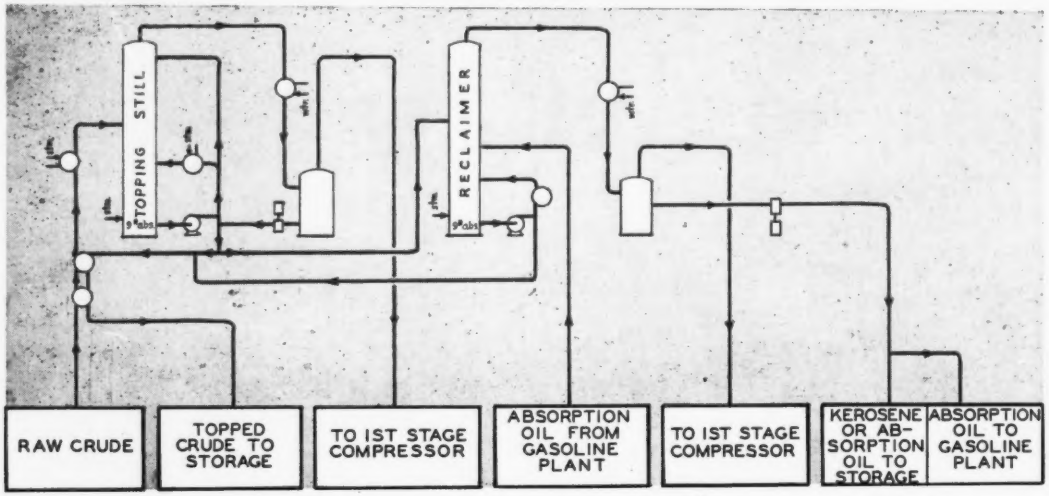


Fig. 2

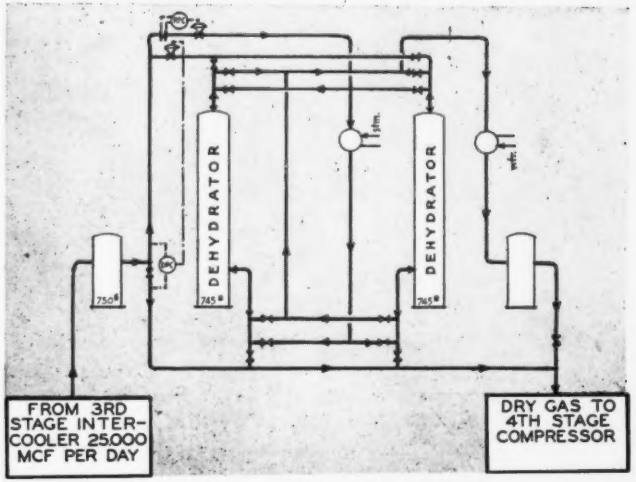
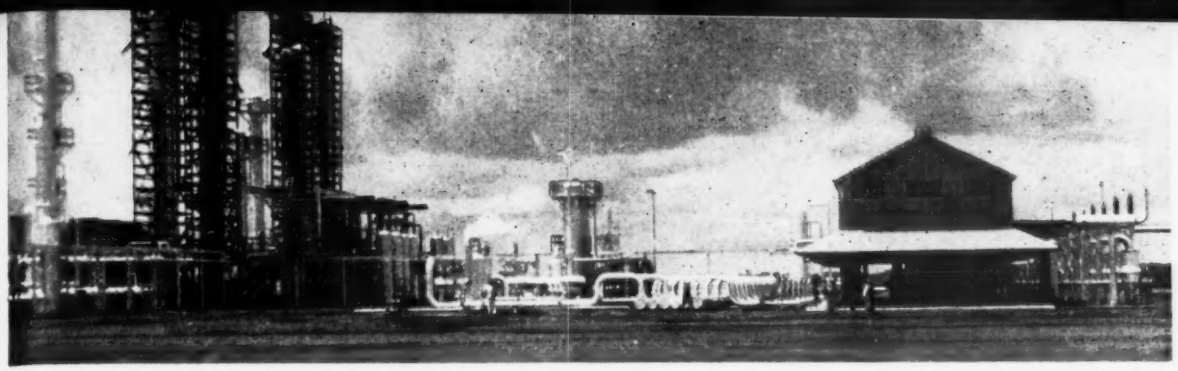


Fig. 3



This is an over-all view of new Sinclair plant. Building at right houses vacuum and compressor units, latter discharging at up to 2,500 psi.

stripped from the lean oil in this column. Lean-oil pressures from the still through the lean oil-rich oil exchangers and to the suction of the lean oil circulating pump. The lean-oil circulating pump pumps the lean oil through the lean-oil cooler and to top of absorber and reabsorber.

The portion of the dissolved hydrocarbon constituents stripped from the rich oil in the flash tower passes overhead from this column through a condenser and into an accumulator where the noncondensable gas separates from the condensed liquid. The remaining dissolved constituents which are stripped from the rich oil in the still are taken overhead from this column through a condenser and into an accumulator where they are totally condensed. This condensed liquid is pumped back into the inlet of the flash-tower condenser. Compression gasoline condensed in the second stage compressor intercoolers is also introduced into the inlet of the flash-tower condenser. Thus the total recovered hydrocarbon stream is passed through the flash-tower condenser and the liquid portion accumulates in the flash-tower accumulator. This type of flow allows for partial stripping only at high pressure and complete stripping at low pressure, while at the same time the advantage of a high condensed pressuring is obtained without the use of recompressors.

Raw gasoline from the flash tower accumulator is pumped through exchangers and into a stabilizer which operates at approximately 300 lb. The bottom product from this column is natural gasoline and the overhead product, which is totally condensed, is butane and lighter. The bottom product is pressured through the bottoms to feed exchangers, a bottoms cooler, and then to storage. The overhead product is pumped into the LPG tower as feed.

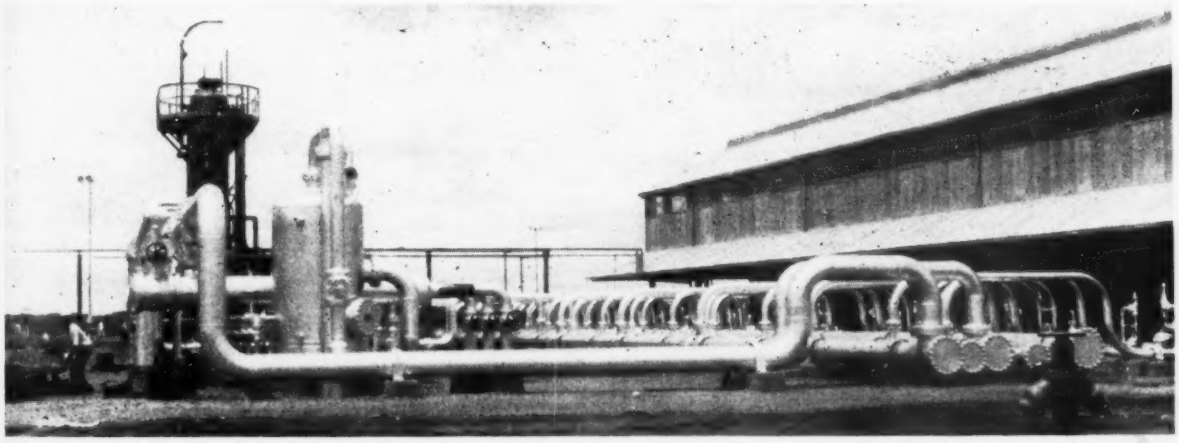
The bottom product from the LPG tower is a mixture of butane and propane, or LPG. The overhead product is propane and lighter. The bottom product is pressured through the LPG cooler and to storage. The overhead product is gas and is passed to the boiler fuel system.

It is possible to operate the stabilizer and the LPG tower so that the stabilizer, operating at 400 lb., acts as a deethanizer. The bottom product from the deethanizer passes as feed to the LPG tower which operates as a depropanizer. The overhead from the depropanizer is propane and the bottom product is depropanized gasoline.

Crude unit.—A crude unit is installed in this plant which can be used to manufacture motor gasoline and kerosene or absorption oil. Due to the physical location of the plant and the unavailability of motor gasoline, kerosene and absorption oil from any refinery source, it was necessary to install facilities to produce these products.

A two-column crude unit consisting of a topping still and reclaimer is installed to manufacture the products mentioned above and, at the same time, to provide a means of controlling the end point of the absorption oil in the gasoline plant.

Raw crude is pumped through feed to bottoms exchangers, a steam heated preheater, and into the topping still which operates at approximately 9 psia. (See Fig. 2). Specification end point motor gasoline is taken overhead from this column and is passed through a condenser where substantially total condensation occurs. The vapor pressure of the gasoline is controlled by the condensing temperature. A vacuum is held on the system by the first-stage compressors in the compressor plant. Stripping steam is introduced below the bottom tray of the topping still in sufficient quantity properly to strip the motor gasoline from the crude. A portion of the bottom product is recirculated through a steam-heated reheater back into the topping still to supply sufficient heat for proper fractionation. The net bottom product may either pressure through the feed to bottoms exchangers and to crude-oil storage or pressure to the reclaimer as feed to this column.



All inter-unit gas handling is consolidated through this central manifold at the compressor plant

The reclaimer is used for the manufacture of kerosene or absorption oil. The primary feed to this column is a portion of the bottom product from the topping still. A small quantity of absorption oil from the gasoline plant may also be fed continuously to this column, the column separating the heavy ends from the desirable absorption oil. The overhead product consists of absorption oil or kerosene, and is totally condensed and pumped to storage or back into the gasoline-plant absorption oil system. Stripping steam is introduced below the bottom trap of the reclaimer in sufficient quantity properly to strip the absorption oil from the crude. A portion of the bottom product is recirculated through a steam-heated reheater back into the reclaimer to supply sufficient heat for the proper fractionation. The net bottom product is pressured through the topping still feed to bottoms exchanger and to crude-oil storage.

Dehydration plant.—A dehydration plant is installed on the discharge of the third stage of the compressor plant. This plant is designed to treat approximately 25,000,000 cu. ft. per day natural gas and to reduce the water dew point so that when this gas is compressed to 2,500 lb. the dew point will not exceed 50° F. The dehydration plant is of the type using a solid desiccant, the desiccant consisted predominantly of Al_2O_3.

The process consists of passing undehydrated gas through a bed of solid desiccant, the bed adsorbing water vapor from the gas stream. The adsorption continues until the desiccant bed becomes sufficiently saturated with water that efficient dehydration is no longer possible. The desiccant bed is regenerated by removing the adsorbed water with a stream of hot hydrocarbon gas, the hydrocarbon gas heating the desiccant bed to sufficient temperature to vaporize the water into the hot gas stream.

Gas from the third-stage intercoolers enters the inlet scrubber at approximately 750 lb. and 95° F. (See Fig. 3). Condensed water and lube oil are removed from the gas stream in the scrubber. Gas passes from the scrubber to the dehydrator where it flows downward through the solid desiccant bed. Dehydrated gas from the bottom of the dehydrator passes to the fourth-stage compressor suction.

A portion of the total plant throughput is used for regeneration. Normally, one dehydrator is dehydrating and the other is regenerating. The regeneration cycle consists of two parts: first, the heating of the desiccant bed and removing the adsorbed water; second, cooling of the desiccant bed. For the heating cycle, the regeneration gas passes through the steam-heated regeneration-gas heater and into the bottom of the dehydrator. The hot gas from the top of the dehydrator passes through the water-cooled regeneration-gas cooler where the water which has been removed from the desiccant is condensed. The cooled gas then passes to the dry-gas line to the compressors. For the regeneration cooling cycle cold regeneration gas passes into the top of the dehydrator and out the bottom, and then to the regeneration-gas cooler and into the dry-gas line to the compressors.

Normal operation allows for a dehydrator to be on dehydration cycle approximately 8 hours. The regeneration cycle consists of 4 hours heating and 4 hours cooling.

It is possible to pass the cold regeneration gas after it leaves the water separator back through the dehydrator which is on the dehydration cycle. This lowers the dew point of the combined gas stream from the dehydration plant but introduces additional pressure drop across the plant.

The quantity of regeneration gas is controlled by a flow-recorder controller, controlling a motor valve in the regeneration gas line. The pressure drop across the plant is controlled by a differential pressure controller, controlling a motor valve in the dehydration-gas line.

Crude-Treating Plant

To handle the cut oil produced in the field a crude treating plant was installed with a capacity of 6,000-8,000 bbl. per day of raw crude. This employs a process of heating and chemical treating and the crude is being treated down to 0.1 per cent b.s. and w. The vapors from this crude-oil plant are also taken into the wet gas stream for processing.

Because of large plant requirements for water, a water station was installed at artesian wells located approximately ¾ mile from the plant site. This station furnishes raw water, which is potable without treatment, to the main camp, and water for hardness treatment, to the plant. The pumps have a capacity of a maximum of 13,000 bbl. per day and at present are pumping approximately 5,000 bbl. per day.

The main plant circulates approximately 6,000 g.p.m. for various uses within the plant and although it is a closed system, considerable make-up water is required. Raw water for plant uses is passed through a lime-soda ash treater unit rated at 350 g.p.m. Four cells of induced draft cooling towers having a capacity of 7,000 g.p.m. cool the water circulated.

Electric Generating Plant

The electrical generating plant consists of three 500-kva. 400-kw., 3-phase, 60-cycle, 4,200-volt generators, each direct connected to a 4-cycle 8-cylinder gas engine. These generators provide electricity for the entire plant, main camp load, and electrification of future pumping wells.

The energy generated is distributed through vertical-lift metal-clad switch gear into one 750-kva. and one 1,500-kva. substation feeder. A separate feeder is provided for processing and for pressure maintenance to reduce the possibility of shutting down the entire plant in case of power failure. Breakers, transformers, push buttons, and separators were fabricated into individual control racks wherever starting or lighting was required. These racks are set on a fabricated steel structure with buss enclosure providing a serviceable and practical installation.

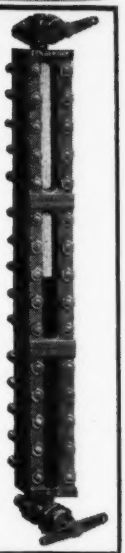
Steam-Generating Plant

The processing steam is generated by four 150-hp. 250 lb. Scotch marine dry back boilers. A 40,000-lb. deaerating heating unit and a bent-tube steam super heater, having 35,000 lb. per hour capacity, of 90 per cent dry steam, supplement the boiler plant.

Generally, all units of this plant are of the latest design, engineering, and equipment. Automatic shutdown stations provide emergency and safety protection for the boilers and field gas, including adequate fire protection. All pressure vessels, including storage tanks, are certified welded to the A.P.I.-A.S.T.M. code. Buildings are heavy steel frame, corrugated iron structures, designed for tropical climate and a high wind load. Plant telephones are interconnected with offices and outside lines which provide greater convenience in operations. Piping for the entire plant was fabricated in the United States and shipped in sections for field assembly. Sufficient gages, flow controllers, motor valves, regulators, liquid-level and pressure controllers are installed to permit safe and flexible operations at all times.

At the present time, the plant is handling between 19 and 20 million cubic feet per day of 50-lb. wet gas. Propane-free natural-gasoline production is running approximately 35,000 gal. per day, with about 10,000 gal. per day of propane which is being vented and burned. The crude topping still is making from 2,500 to 3,000 gal. of motor fuel per day depending upon requirements and is also making all requirements for absorption oil. This gallonage varies from around 350 to as much as 2,150 gal. per day, maximum absorber-oil recovery being obtained when motor fuel is not being made. The plant has not been in operation a sufficient length of time to obtain any data as to the results of gas injection into the producing reservoir. Future production statistics, bottom-hole pressure, and gas-oil-ratio data, will be necessary to make this determination.

PENBERTHY
"REFLEX"
DROP FORGED STEEL LIQUID LEVEL GAGES



Liquid always shows black—empty space shows white. Preferred where the liquid level must be easily and positively visible, and when liquids are under high pressure or at high temperature. Made of alloy temperature resisting steel and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Reflex" is one of the complete line of Penberthy Gages that meet every liquid level gage requirement.

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"REFLEX"
WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black—steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

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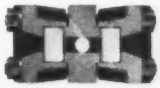
DROP FORGED STEEL LIQUID LEVEL GAGES

Used to observe color and density of liquids under high pressures and/or temperatures. Construction exceptionally sturdy. Made of alloy temperature resisting steel, and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Transparent" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.



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SUMP PUMPS

Used wherever seepage water accumulates, the Penberthy Automatic Electric Sump Pump and the Penberthy Automatic Drainer (water or steam operated) have demonstrated their superiority in this service. Simple and rugged design—copper and bronze construction throughout.

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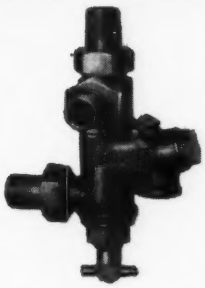

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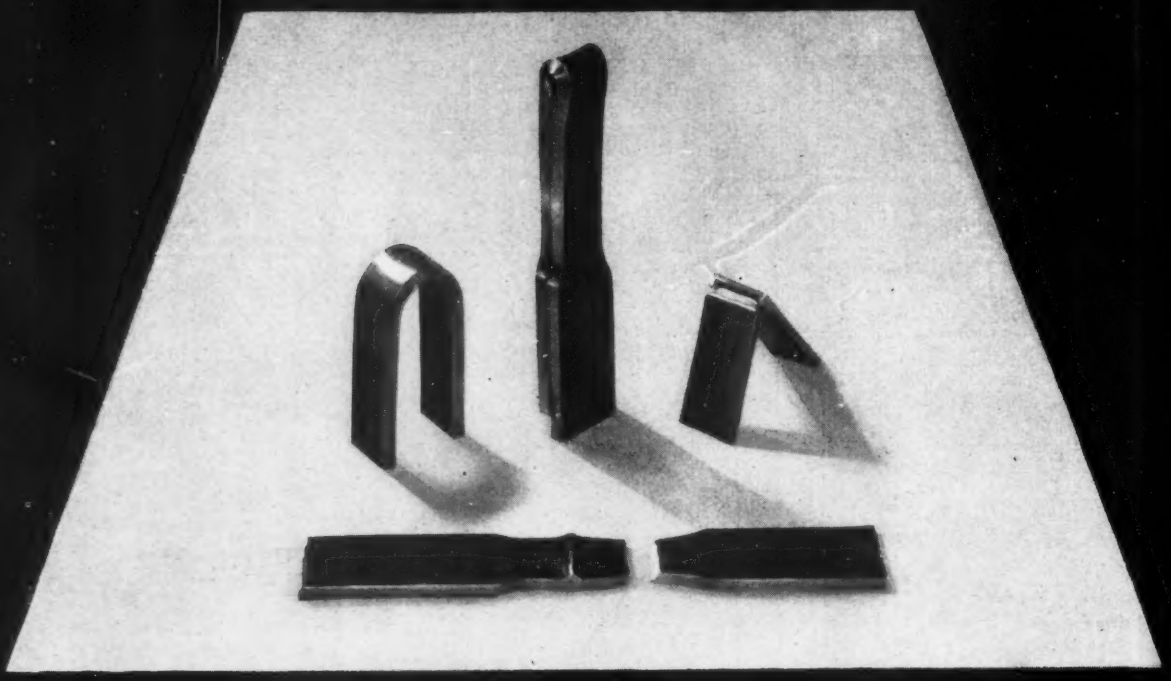

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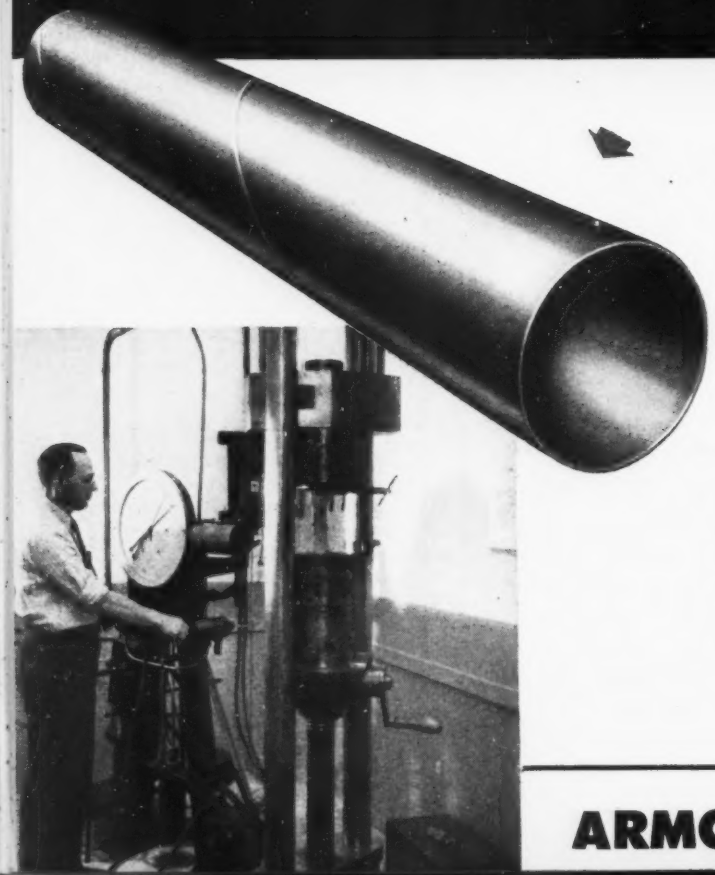

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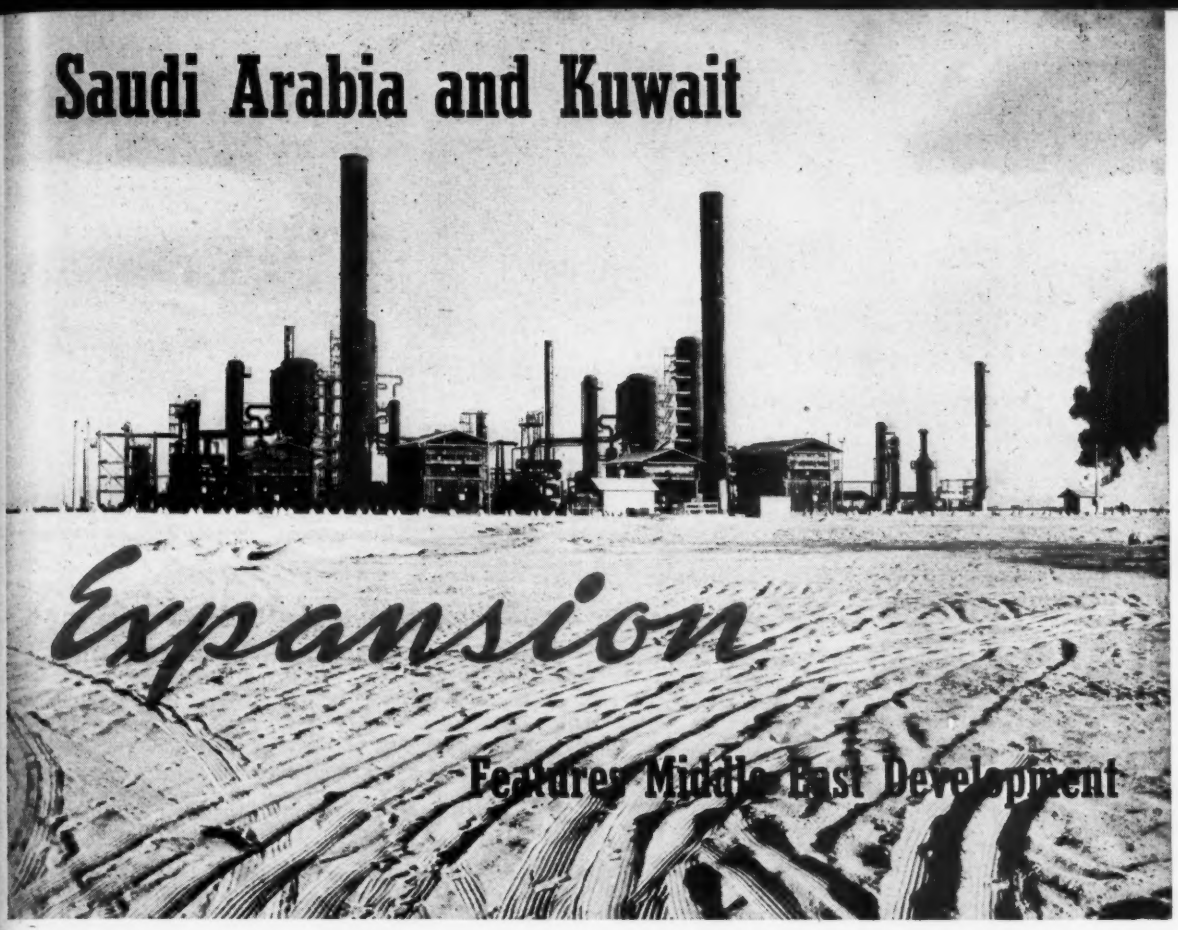
Saudi Arabia and Kuwait



Expansion

Features Middle East Development

General view of crude stills at the Ras Tanura refinery of Arabian American Oil Co. in Saudi Arabia

WITH expansion over the past year centering in Saudi Arabia and Kuwait, the Middle East at the close of 1946 was firmly entrenched as the second largest oil-producing area outside the United States. The crude-oil output of the region, consisting of six countries, totaled 779,000 bbl. daily at the close of this year, being exceeded only by Venezuela with an output of 1,100,000 bbl. daily. On a basis of developments over the past 12 months, additional geologists and economists familiar with world-wide oil operations are in agreement that the proven and probable petroleum reserves of the Middle East exceed those of any other oil area.

Most of the increase in Middle East field and refinery output during 1946 is accounted for by the enlarged production of Saudi Arabian fields and refinery, and the refinery located on the nearby island of Bahrein of the Persian Gulf. The output of the two refineries is now approximately 190,000 bbl. daily and in addition the operating company in Saudi Arabia has offshore shipments to Europe and Argentina.

The deliveries from the new terminal of Kuwait Oil Co., Ltd., in Kuwait now total 40,000 bbl. daily. The Burgan field in Kuwait, which is believed to represent one of the largest if not the largest single oil reserve of the petrolum industry, had no outlet until May of this year.

In general, operations in the Middle East during the first postwar year have not followed the pattern that was projected by many observers during the closing months of World War II. It was thought at that time that Middle East operations would experience a substantial reduction from the demand levels of the war period due largely to a contraction in military purchases. This anticipated development has not taken place. Military demands, centering in the purchases of the United States and British navies, have continued heavy and these requirements, plus the civilian markets have readily absorbed the enlarged output of the Persian Gulf area.

In this connection the Middle East has benefited from the slow rehabilitation of the fields and refineries of the Far East. Previous to the war the field and refinery output of the Far East, including the East Indies, India, Burma, and Japan, totaled approximately 225,000 bbl. daily. This output is now estimated to be 50,000 bbl. daily. Political conditions and lack of skilled manpower and equipment have delayed the rehabilitation of the oil properties, practically all of which were held by the Japanese during the war. Some of the properties were partially or wholly destroyed by the operating companies at the direction of the Netherlands and British governments previous to Japanese occupation.

A large part of this Far East market normally supplied by the fields and refineries of the East Indies and India now obtain products from the refineries of the Persian Gulf. The navies operating in the Orient area, and the United States and British occupation forces are also large consumers of Middle East petroleum. At present there are no indications that the rehabilitation of Far East oil properties will be expedited, a situation which points to a continued important market for Middle East oil through 1947.

Looking to the time when the petroleum output of the Persian Gulf fields will exceed the local and Far East demands, plans are being discussed providing for the construction of one or more big-inch pipe lines from the Persian Gulf to the Eastern Mediterranean. Arabian American Oil Co., owner of the Saudi Arabian concession and operations, has announced plans for the laying of a line to a shipping point on the Eastern Mediterranean and preliminary surveys

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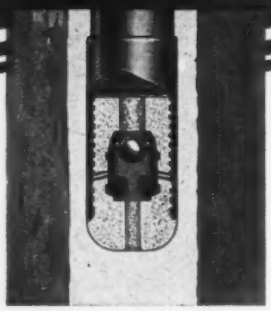

Here's how the casing string is safely guided and floated in with a Baker Cement Wash-Down WHIRLER Float Shoe, its rounded concrete nose leading the casing past any sidewall irregularities. Floating-in is safely performed by means of the Baker Ball-Type Back-Pressure Valve which prevents the passage of fluid up through the bottom of the pipe while running in.

Here's how bridges are removed and washing-down is performed by the downward hydraulicking action of the circulating fluid through the baffled WHIRLER ports and the restricted bottom passageway. Years of experience have proved that the "engineered" angle of the down-whirler ports, and the combined area of these outlets in balance with the bottom outlet, effectively disintegrate and circulate away bridges and similar obstructions.

Here's how mud cake is removed and the hole conditioned for successful cementing by the WHIRLING motion given to the fluid when the formation is washed and conditioned. The DOWN-WHIRLER ports direct the fluid at an *angle* which insures effective removal of the mud cake but does *not* break down heaving or crumbling formations. The original formation is left clean for bonding with the cement slurry.

Here's how the slurry is WHIRLED—first down, then up—to encase the shoe joint completely with a continuous body of cement. The critical area at the shoe as well as the casing up the hole, is encased by the cement slurry, and the WHIRLING action minimizes the hazard of channeling. An added feature is the ease of drilling out and circulating away the plastic valve assembly and the concrete plug.

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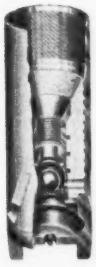
All of the basic BAKER features of Strength, Valve Efficiency and Drillability are present, PLUS the vital ability of WHIRLING the circulating fluid, and then the cement slurry, described and illustrated on the opposite page. Here you can clearly see the plastic ball in cementing position, with ample passageways for fluid circulation—also the baffled ports which direct the fluid, or cement slurry, downward with a WHIRLING motion—also the recessed rubber seat for the buoyant ball which floats upward to a leak-proof seal at the slightest reversal of pressure. This is your best bet for successful, "first-time" cementing.

This is the Baker Cement Wash-Down WHIRLER Guide Shoe (Product No. 121) which is used by many modern operators who demand the advantages of WHIRLING the cement slurry, but prefer to have a Baker Cement Float Collar positioned a joint or two above the shoe where it will serve as a stop for the cementing plug, thus retaining any cement "tailings" inside the casing. Successful Guiding, Floating and Cementing plus WHIRLING are assured with this combination.

Baker Cement WHIRLER Float Collars with Solid Baffle (Product No. 305) are used for cementing casing at any desired depth, and are particularly adaptable for cementing a combination string where the upper portion is to be used as a water string and the lower portion as on oil string. The downward WHIRLING of the cement slurry continues as the slurry starts upward, to afford uniform cement distribution with minimum danger of channeling.



Baker Duplex Cement Wash-Down WHIRLER Shoes (Product No. 360) are used to perform the lower stage (at the shoe) of a two-stage cementing job, or to run in and cement a liner either landed on bottom or up the hole, the top of the liner being either below the casing shoe or lapping into the casing.

Baker Metal Petal Baskets (Product No. 340) play an indispensable part in WHIRLER cementing when used with Baker Cement WHIRLER Type Collars. These Baskets are constructed with metal petals which overlap in expanded position and serve as a bridge to protect the formation below from cement contamination, sloughings or cavings. They are run on casing or liner, either fixed or slideable, in combination with Hook-up Nipples and WHIRLER Type Collars (illustrated at left), as well as in Double Basket and Inverted Basket Assemblies for a wide range of cementing applications, many of which would be extremely difficult to perform if Baker Metal Petal Baskets were not available.

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have been made. Right-of-way has been obtained over part of the area through which the line will extend. It is reported that the operating companies in Southwest Iran and Kuwait are also considering the laying of a Persian Gulf-Mediterranean pipe line.

The objective of these lines is to reduce costs in making crude oil or products available to the markets of Western Europe and possibly parts of the Western Hemisphere. The distance from Abadan at the upper end of the Persian Gulf to the Eastern Mediterranean is approximately 3,300 miles via Red Sea, Gulf of Suez, and Suez Canal. From the Saudi Arabia-Bahrein Island terminals the distance is approximately 3,120 miles. The proposed pipe-line movement would eliminate this long tanker haul and also save the Suez Canal toll of approximately 18 cents per barrel.

It is agreed that the petroleum markets of Western Europe are the logical outlet for the enlarged production of the Middle East which will be further expanded as operating facilities are available. Previous to the war very little of the Persian Gulf production was transported to European markets which were largely supplied by Iraq, Romania, and the Western Hemisphere. The principal Western Hemisphere sources were Venezuela and Netherlands West Indies refineries and the United States. The building of one or more big-inch Persian Gulf-Eastern Mediterranean pipe lines will greatly strengthen the position of the Persian Gulf operators in competing for the European markets with producers and refiners in the Western Hemisphere.

Iran

No major changes or important discoveries in Iranian oil operations have been reported during the past year. The production of the Southwest Iran fields, the pioneer producing area of the Middle East, was greatly expanded during the 1943-1945 period with a corresponding increase in the output of the Abadan refinery. Over the past year considerable repair and maintenance work, which could not be done during the war period, has been completed. Anglo-Iranian Oil Co., Ltd., owner and operator of the concession, has also carried on geological work looking to further wildcat tests on its concession of 100,000 sq. miles, only a small part of which has been tested with exploratory drilling.

Plans for the construction of a large catalytic-cracking unit at the Abadan refinery have been announced and other processing and treating facilities will be installed at the refinery which now has a capacity of 400,000 bbl. daily. A large lubricating-oil plant is also projected. More settled political and labor conditions are desirable as a background for further expansion of Iran's petroleum resources which now account for about 60 per cent of the present Middle East production.

Iraq

Plans announced shortly after V-J Day to increase the production of Iraq Petroleum Co., Ltd., for 90,000 to 300,000 bbl. daily from the Kirkuk field in northern Iraq are slowly getting under way. It is now predicted that this project will not be completed before late 1948 or early 1949. Political conditions in the general area in which the operations are located and lack of materials are offered in explanation for the delays.

The expansion of 300 per cent in production capacity can be accomplished with a minimum of additional facilities other than pipe lines. The present program calls for the production of 300,000 bbl. daily from one end of the 65-mile long Kirkuk field. It is expected that the higher rate of output can be maintained with 20 flowing wells. The field is generally credited with having a minimum reserve of 5 billion barrels.

The principal new expenditure will be the laying of two 16-in. lines paralleling the existing 12-in. lines which have been in operation since 1934. The terminals of these lines are at Tripoli, Lebanon, and Haifa, Palestine. The company will also build additional crude-oil-stabilization facilities in the field.

Iraq Petroleum Co., Ltd., is jointly owned and operated by four companies as follows: d'Arcy Exploration Co., Ltd. (Anglo-Iranian); Anglo-Saxon Petroleum Co. (Royal Dutch-Shell); Compagnie Francaise de Petroles (controlled by the French Government); and Near East Development Co. (Standard Oil Co. of New Jersey and Socony-Vacuum Oil Co., Inc.). Each of these companies has a 23¾

Drilling operation of Anglo-Iranian Oil Co., Ltd., in Southwest Iran, with all-Iranian crew trained by the company

REFINERIES OF THE MIDDLE EAST*

Company and plant location—	Capacity, bbl. daily— Crude oil	Cracking
Anglo-Iranian Oil Co., Ltd., Abadan, Iran	400,000	125,000
Kermanshah Petroleum Co. (Anglo-Iranian), Kermanshah, Iran, and Alwand, Iraq	2,100	.....
Arabian American Oil Co., Ras Tanura, Saudi Arabia	90,000	(†)
Bahrein Petroleum Co., Ltd., Bahrein Island	110,000	29,000
Consolidated Refineries, Ltd., Haifa, Palestine	84,000	33,000
Anglo-Egyptian Oilfields, Ltd., Suez, Egypt	35,000	6,500
Egyptian Government, Suez, Egypt	1,750	.....
Total	722,850	193,500

*Does not include several small topping plants located in fields supplying local markets. †Reforming capacity only.

MIDDLE EAST FIELD OPERATIONS

Company and Middle East headquarters—	Location of concession	No. of active fields	No. of active wells*	Production, bbl. daily
Anglo-Iranian Oil Co., Ltd., Abadan, Iran	Iran	6	64	422,000
Arabian American Oil Co., Dhahran, Saudi Arabia	Saudi Arabia	1	40	§173,000
Bahrein Petroleum Co., Ltd., Bahrein Island, Persian Gulf	Bahrein Island	1	62	23,000
Iraq Petroleum Co., Ltd., Haifa, Palestine, and Kirkuk, Iraq	Iraq	†2	†11	96,000
Kuwait Oil Co., Ltd., Kuwait, Persian Gulf	Kuwait	1	5	40,000
Total		11	182	754,000
Anglo-Egyptian Oilfields, Ltd., Cairo	Egypt	2	100	25,000
Petroleum Development (Qatar), Ltd., Manama, Bahrein Island, Persian Gulf	Qatar	‡1	‡2	.....

*Does not include inactive wells and observation wells. †Includes one well of the Anglo-Iranian Oil Co., Ltd., in the Naft Khaneh field, producing 6,000 bbl. daily. ‡Inactive. §Production in late December was 200,000 bbl. daily.

Aerial view of Abadan refinery of Anglo-Iranian Oil Co., Ltd., The incoming pipe-line track from the oil fields is seen in right background

per cent interest in the Iraq company and the remaining 5 per cent held by C. S. Gulbenkian and associates.

The Shell and Anglo-Iranian companies are owners of Consolidated Refineries, Ltd., which operates an 84,000-bbl. refinery adjoining the pipe-line terminal at Haifa. Standard Oil Co. of New Jersey and Socony-Vacuum Oil Co., Inc., have sites for refineries at Tripoli, and in late 1945 plans to build the plants were announced. There have been no later developments in regard to the projects. The French interests in the company have refinery facilities in France, much larger in capacity than the present French share of the Iraq output. Part of the present Iraq output is being refined at Haifa and the remainder is being delivered to French refineries.

The same four interests are associated in the operations of other concessions located in the Middle East. These interests include companies with large concessions on the Trucial Coast, southern Iraq, Trans-Jordan, Palestine, Aden, Syria, and Cyprus. The company is carrying on geological work on these concessions but wildcat drilling has not been reported.

The four companies are owners of Petroleum Development, Ltd., which has a large concession on the Peninsula of Qatar on the Persian Gulf. Previous to the war the operating company discovered what is commonly known as the Dukhan field. Two wells were completed 10 miles apart. They are believed to have discovered a large reserve which will be developed as soon as operating facilities and markets are available.

Kuwait

The discovery well of the Burgan field in Kuwait, an independent sheikdom at the upper end of the Persian Gulf, was completed in 1938. Eight additional wells were drilled before it was necessary to shut down all operations during the war. These eight wells outlined what is credited with being a proven reserve of from 5 to 10 billion barrels. Operations were resumed after the close of the European war.

A marine terminal at Fahahil on the Persian Gulf connected to the field by pipe line was completed in May of this year and tanker deliveries were started. These deliveries now total about 40,000 bbl. daily. As in the case of the Kirkuk field, future development is not dependent on the drilling of a large number of additional wells but in providing outlets for existing wells. Present production is coming from five wells. There have been reports that Kuwait Oil Co., Ltd., has plans to build a refinery near the Kuwait terminal and also that the Anglo-Iranian Oil Co., Ltd., and the Gulf Oil Corp., joint owners of the Kuwait company, would build refineries at other points to be operated with Kuwait crude. No wells are drilling in the field at this time.

Egypt

The only new discovery reported in Egypt this year was the successful completion of a wildcat well at Sudr, 40 miles south of the city of Suez on the east coast of the Sinai Peninsula by the Anglo-Egyptian Oilfield, Ltd. (Shell), and the Egyptian subsidiary of the Socony-Vacuum. The size of the field has not been determined. The wildcat test of the Standard Oil Co. of Egypt (Standard of New Jersey) located near the pyramids outside Cairo was a dry hole. The same company is drilling two wildcat tests in the Sinai desert. Still greater activity in wildcat operations is in prospect for 1947 by the three operating companies, each of which has large concessions in Egypt.

Anglo-Egyptian Oilfields, Ltd., is the only company with production and refining facilities in Egypt. The company has expanded the capacity of its refinery at Suez to 35,000 bbl. daily.

Saudi Arabia-Bahrein

By far the most important developments of the year in the Middle East have taken place in the kingdom of Saudi Arabia and the adjoining island of Bahrein, an independent sheikdom of the Persian Gulf. The two areas are properly considered together because Arabian American Oil Co., the operating company in Saudi Arabia, and Bahrein Petroleum Co., Ltd., operating in Bahrein, are jointly owned and operated by Standard Oil Co. of California and The Texas Co. Standard of California was the discovery operator in both countries.

It was announced in mid-December that Standard Oil Co. (N.J.) and Socony-Vacuum Oil Co., Inc., were negotiating with the owners of Arabian American Oil Co. for the purchase of a substantial participation in the Arabian American company. These two companies as previously explained, are the owner of Near East Development Co., which has a 23¾ per cent interest in Iraq Petroleum Co., Ltd., and are also a one-fourth owner in other companies which have large exploratory concessions in the Middle East.

The Bahrein field operations have changed little over the past year. The one field, which was discovered in 1932, has a controlled flowing production of 23,000 bbl. daily. Some test work has been done on deeper pays for both oil and gas and additional prospecting is projected.

The company's refinery located adjacent to the field has been expanded over the past year and is now refining approximately 110,000 bbl. daily. The difference between the Bahrein production and the refinery crude runs to stills is supplied by a marine pipe line connecting to the production on the mainland of Saudi Arabia. The operating camp at Awali on Bahrein Island has been expanded in housing facilities over the past year. The refinery was expanded to include catalytic cracking, alkylation, and isomerization facilities during the war.

Large Revenue Gain

Probably the additions to proven reserves in Saudi Arabia exceed those of any other country over the past year. The deep pay of the first field—Dammam—was discovered n 1938 and until the early part of this year all the production available in Saudi Arabia came from this field. This year a 14-in. pipe line was completed to the Abqaiq field, 40 miles from

(Continued on page 213)

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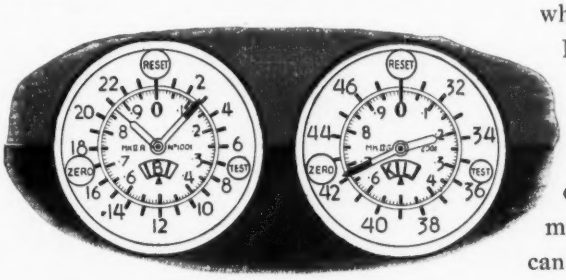

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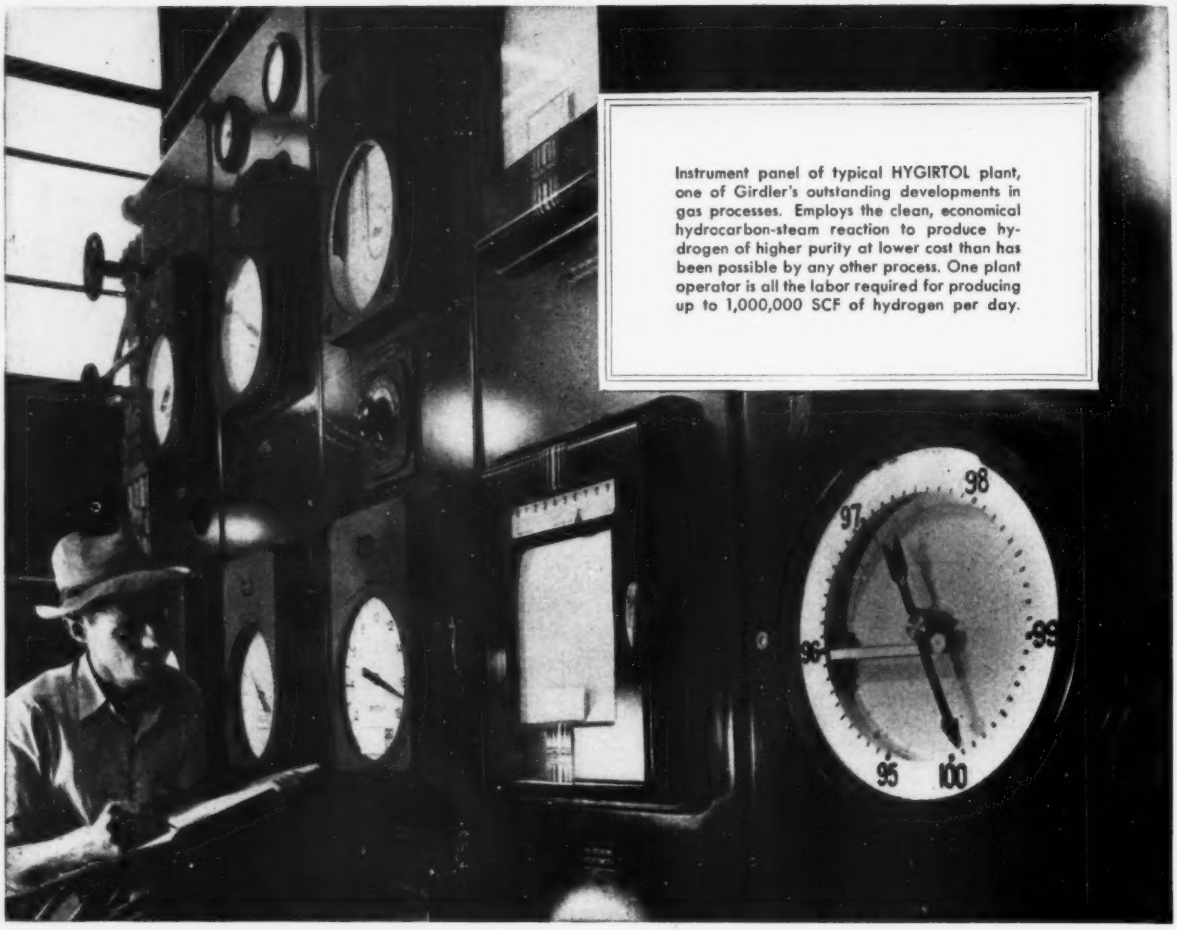

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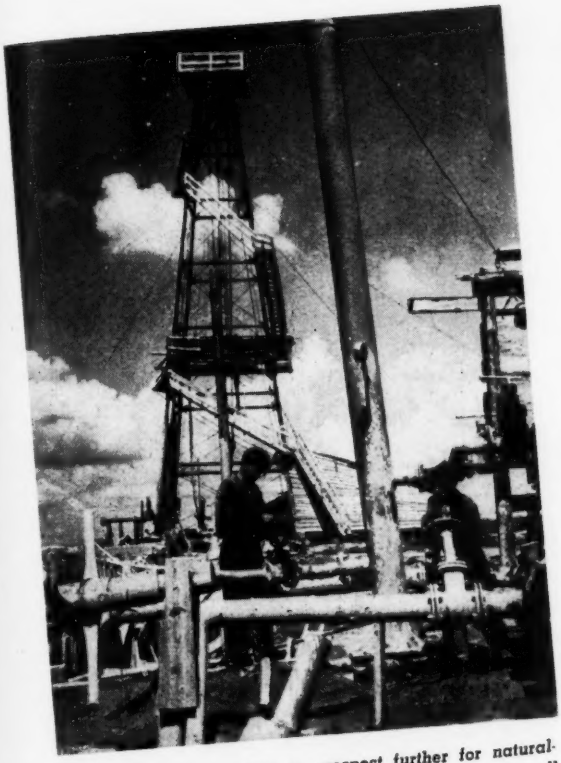


Soviet geologists continue to prospect further for natural-gas deposits in the area of Yelshensk. Here is gas well No. 32. (Sovfoto)

U.S.S.R. Needs Equipment

to maintain its present operations and provide for future expansion

by Warren W. Burns

WHILE considerable secrecy continues to shroud official Russian Government oil statistics, the latest information available, and which is thought to be relatively accurate, indicates that Russian crude-oil production during the war dropped from 620,000 bbl. daily in 1940 to 406,000 bbl. daily in 1945, a decline of 214,000 bbl. daily.

This information is based upon figures in the accompanying Table 1 and was compiled by Andrew D. Perejda, a geographer and cartographer in the U. S. Government. His article on "The Position of Russia in the Oil Age" was published in a recent issue of The American Review on the Soviet Union, a quarterly publication of the American Russian Institute in New York City.

During 1946—the first full year after World War 2—it is believed that daily production has slowly increased. Petroleum economists in the United States estimate current daily production to be somewhere between 450,000 and 500,000 bbl. daily. Earlier this year unofficial estimates were that Russia's daily production was up to 550,000 bbl.

In 1938, The Oil and Gas Journal estimated Russia's crude production, for that year, to be 217,535,000 bbl. In Table 1, Perejda's figures indicated that annual production climbed to 226,464,810 bbl. in 1940 then dropped to 148,539,600 bbl. in 1945.

During the war approximately 3,000 oil wells, with an annual yield of around 5,000,000 tons (37,000,000 bbl.) were destroyed, according to an unofficial U. S. source. Detailed percentages on Russia's loss in World War 2 are given by Perejda as follows:

"Baku, the largest producing region, dropped 9 per cent in 1945 as compared to 1940—from 70 per cent to 61 per cent of the total Russian production. The Maikop-Grozny region,

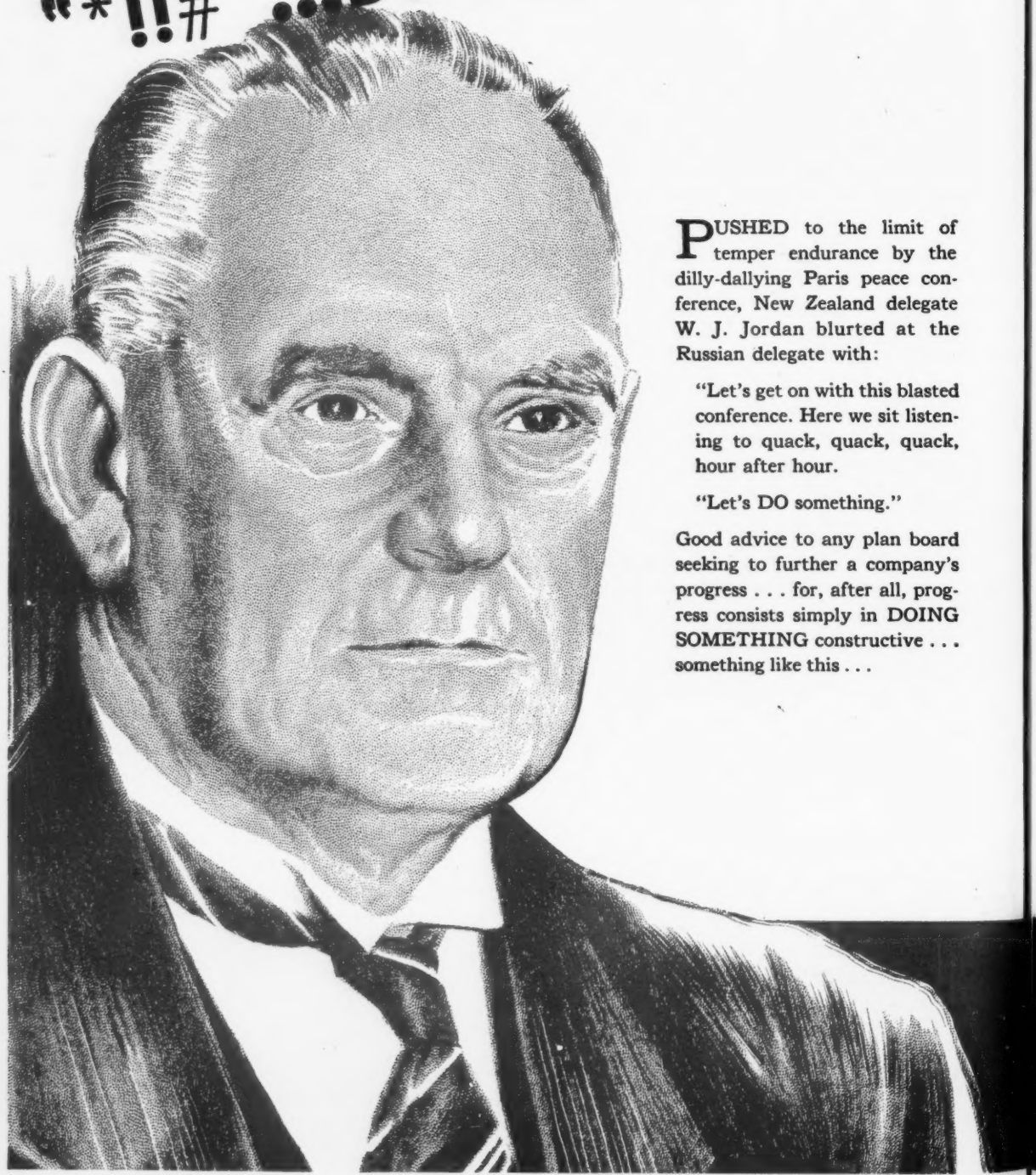
TABLE 1—RUSSIAN PRODUCTION IN 1940 AND 1945

	1940		1945	
Oil fields—	Metric tons*	Per cent of total U.S.S.R. prod.	Metric tons*	Per cent of total U.S.S.R. prod.
Baku	21,800,000	69.89	12,500,000	61.09
Maikop	5,100,000	16.35	100,000	00.48
Grozny			1,300 000	06.35
Dagestan			350,000	01.71
Total Caucasus	26,900.000	86.24	14,250,000	69.63
Ishimbaevo and Tuimazy	1,510.000	04.84	1,000.000	04.88
Burgurslan	10.000	00.03	485.000	02.37
Kuibyshev	300.000	00.96	1,250.000	06.10
Kransnokamsk	100,000	00.32	150,000	00.73
Total "Second Baku"	1,920,000	06.15	2,885,000	14.08
Emba Basin	690.000	02.21	1,000.000	04.88
Turkmenia	578,000	01.85	650.000	03.17
Kalininneft†	98,500	00.31	295.000	01.44
Voroshilovneft‡	150,000	00.48	80.000	00.39
Ukraine and Crimea	400.000	01.28	400.000	01.95
Sakhalin (Island)	475,000	01.47	900,000	04.39
Total Non-Caucasus	4,293,500	13.75	6,210,000	30.30
Total U.S.S.R.:				
Metric tons	31,193,500	....	20,460.000	....
Barrels	226,464,810	....	148,539,600	....

*Conversion factor for the mainland of U.S.S.R. adopted by the U. S. Bureau of Mines is 7.266 bbl. per metric ton. For Sakhalin the conversion factor is 6.820. †Bukhara-Fergana area. ‡Upper Amu-Darya River area around Termez.

then he said to himself:

"*!!#*...DO SOMETHING!"

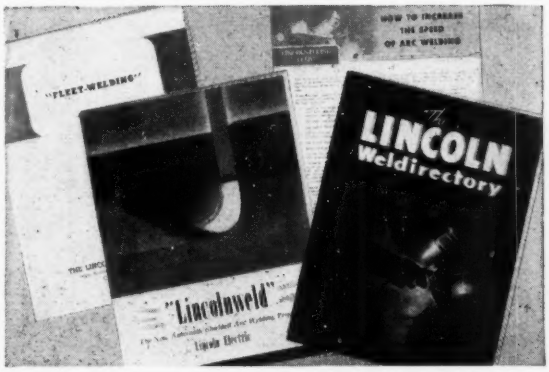


PUSHED to the limit of temper endurance by the dilly-dallying Paris peace conference, New Zealand delegate W. J. Jordan blurted at the Russian delegate with:

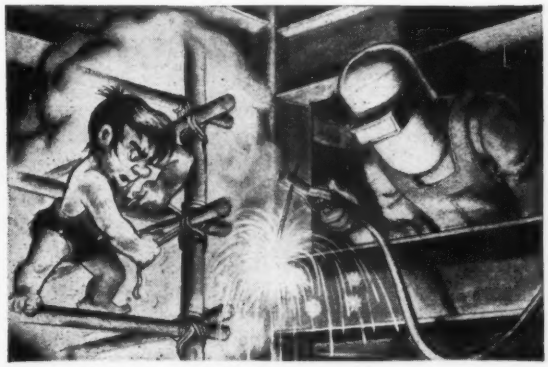
> "Let's get on with this blasted conference. Here we sit listening to quack, quack, quack, hour after hour.
>
> "Let's DO something."

Good advice to any plan board seeking to further a company's progress . . . for, after all, progress consists simply in DOING SOMETHING constructive . . . something like this . . .

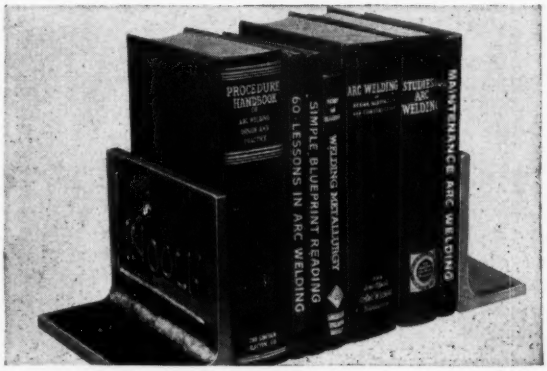
Look, Mr. Jordan, **how Lincoln is helping engineers, production men and executives DO SOMETHING constructive with arc welding:**



CUT WELDING COSTS. To help supervisors and foremen use arc welding more economically, Lincoln publishes a series of procedure sheets and will send these on request. Procedure bulletins on manual and automatic welding are available to engineers and supervisors. Write us, stating your particular application.



SOLVE DESIGN PROBLEMS. The Lincoln sound-color movie, "Design for Arc Welded Structures" depicts the progress of construction from cave man days . . . is packed with ideas for design and lower costs. Full details in Bul. 719. "The Prevention and Control of Distortion in Arc Welding", explains the causes and cures of distortion. Ask for Bul. 709.



LEARN FROM OTHERS. The Lincoln library of arc welding knowledge includes the world's leading books on all phases of the subject. New 8th Edition Procedure Handbook contains 1312 pages of latest facts gathered by experts the world over. Price, $1.50 (postpaid in U.S.A.). Write for free Bul. 713 and Bul. JFLF 128 on Lincoln books.

ASK FOR ADVICE. Mr. R. H. Davies, Consulting Engineer of The Lincoln Electric Company, will come to your plant for three days or longer for an advanced course in welding engineering and to discuss welded design as applied to your problems. Write to R. H. Davies for details. The cost for this service is small.

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TULSA, OKLAHOMA

which was occupied by the Germans, dropped drastically in production from 16 per cent of the total U.S.S.R. production in 1940 to 7 per cent in 1945 with the complete retreat of the German armies.

"During the period of occupation no production was obtained by either the Russians or the Germans because of the destruction of the fields. In this period of occupation, one can safely say that U.S.S.R. lost over 16 per cent of her production yearly, or roughly 5 to 6 million metric tons (approximately 35 to 42 million barrels) of oil during each year of occupation by the Germans.

"When we stop to consider this percentage we see that it amounts to more petroleum than the production from all the other non-Caucasus regions combined, which produced only 14 per cent of the total U.S.S.R. production in 1940 (4,293,500 metric tons, or 30,054,500 bbl.). The whole Caucasus area dropped in production from 86 per cent (26,900,000 metric tons, or 188,300,000 bbl.) in 1940 to 70 per cent (14,250,000 metric tons, or 99,750,000 bbl.) in 1945 (a drop of 16 per cent) despite the slight production in 1945 of 1,400,000 metric tons, or 9,800,000 bbl., from the Maikop-Grozny region which was put into operation with the retreat of the Germans."

Wartime production in the "Second Baku" — located between the Volga and the Urals—increased appreciably as is indicated by Table 1. About 400 of an estimated 2,000 salt domes in this area have been mapped. Production in the Second Baku rose from 6 per cent in 1940 to 14 per cent in 1945 of the total Russian production for each respective year.

The greatest marked Russian wartime production was on the island of Sakhalin, located off Russia's eastern coast and directly north of Japan. By terms of the Yalta agreement, Russia obtained the southern half of this island which formerly belonged to Japan. Prewar production in southern and northern Sakhalin has been estimated at 2,190,000 bbl. yearly each, or a yearly total of 4,380,000 bbl. According to Perejda's figures, 1940 production in Sakhalin was 457,000 metric tons, or 3,199,000 bbl., and in 1945 it was increased to 900,000 metric tons, or 6,300,000 bbl.—practically double.

Perejda points out that in addition to the seven well-known oil fields and six prospects on the east coast of Sakhalin Island, Russia is showing interest in two oil and gas seeps on the west coast. One of these is in the Langary River Valley and the other near the fiftieth parallel near N'chaichai. Both prospects are on north-south trending anticlinal folds. The rock formations with oil indications are of Tertiary age.

Early this year Marshal Stalin set Russia's 1950 production at a hoped-for 35,400,000 metric tons (261,960,000 bbl.) and the yearly production of 60,000,000 tons (435,000,000 bbl.) by 1960. However, Russia's production in the years immediately ahead will, undoubtedly, hinge largely upon how soon and how much oil-field equipment can be purchased abroad—meaning largely from the United States.

Meanwhile, large-scale exploration programs are reported under way in various Russian areas. In the current 5-year plan the Second Baku is expected to yield even greater production. By 1950 production in the Volga districts is expected to be increased eleven-fold compared with 1940, and in the Urals by 320 per cent. Pipeline and refinery construction are also expected to be increased greatly—probably in direct proportion to the amount of equipment which can be purchased abroad.

Russia's U. S. Imports

An indication that Russia's 1945 production fell far short of providing all domestic needs for petroleum products are figures from the U. S. Department of Commerce which show that during last year Russia imported, from the U. S. alone, 4,787,584 bbl. of products. These included aviation motor fuels, gas oil and distillates, lubricating oils and other motor fuels, as well as antiknock compounds. It is also known that petroleum imports from Soviet-dominated Balkan countries were considerable in 1945 and 1946, but no official figures are available.

Considerable success in developing a commercial oil field at Tuimazy, between the Volga and the Urals, in Bashkiria, has been reported by the Soviet press. Exploration was delayed here by the war until 1944, when a well was drilled to a depth of 2,000 m. (6,400 ft.) into the Devonian. By the end of this year Tuimazy is slated to have 15 wells producing at an estimated rate of 4,000 tons (29,600 bbl.). By 1950 the Russians hope to see Tuimazy producing 10 per cent of the country's entire crude output.

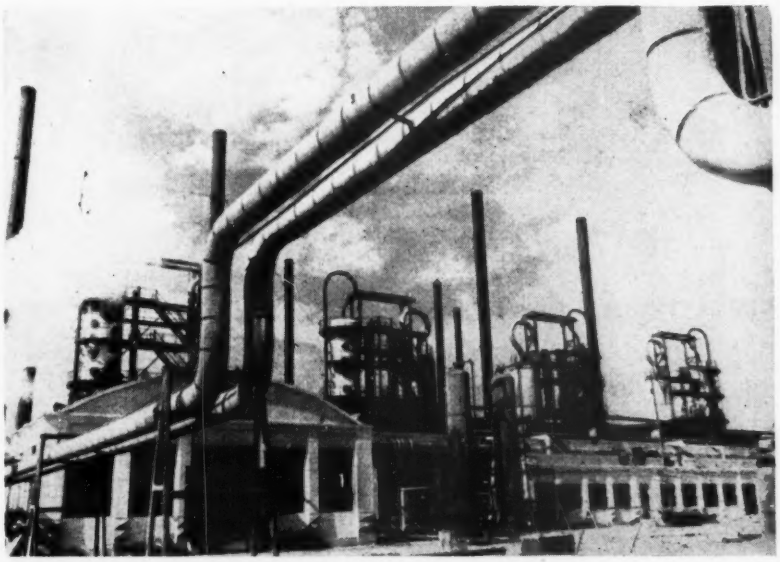
In the Baku region, the U. S. Department of Commerce states, wildcatting has almost doubled and at Buzovny a new oil field was recently announced. Three flowing wells with a daily combined potential of 175 metric tons (1,295 bbl.) are in production in a new field at Tash-Kala in the Grozny region. The prewar level of production in Grozny, Dagestan (in the Caucasus) and Kransnodar is not expected to be restored for some time yet, due to wartime devastation.

Russia's total crude-oil reserves have always been an interesting topic among oil men. Prof. Ivan M. Gubkin, noted authority on Russian petroleum reserves, set an original estimate of 2,485,000,000 tons, or approximately 18,037,000,000 bbl., broken down as follows:

Region—	Metric tons
Baku	1,325,000,000
Emba	640,000,000
Grozny	138,000,000
Middle Asia	240,000,000
Maikop	82,000,000
Bashkiria	60,000,000

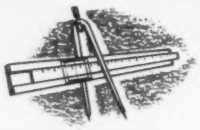
Commenting on these reserve figures, Geographer Perejda says:

"Including other possible reserves, Professor Gubkin set the total at a maximum of 3,000,000,000 tons (22,200,000,000 bbl.). Later, at the Seventeenth International Geological Congress, held in Moscow in 1937, Gubkin placed the petroleum reserves of the U.S.S.R. at 6,376,300,000 metric



One of the modern refineries in the U.S.S.R. (Sovfoto)

GASOLINE, NATURAL GAS, BUTANE AND DIESEL ENGINES



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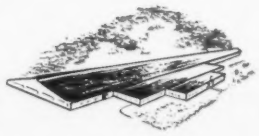

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Production line techniques are employed. Inspections are undertaken at every station on the line.

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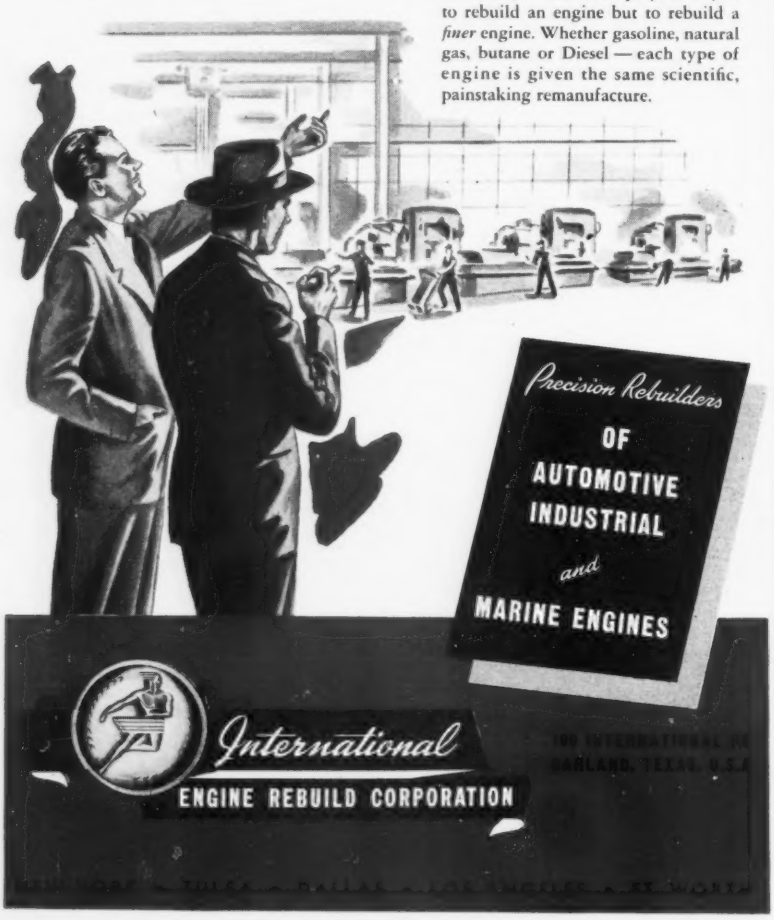

tons, or roughly 46,291,938,000 bbl.

"Considering the fact that the total proved petroleum reserves of the world are set at 59,000,000,000 bbl. as of January 1, 1946, the optimistic total for the U.S.S.R. . . . would amount to about four-fifths, or more precisely 78 per cent of the total world petroleum reserves.

"The United States which has, by comparison, only 20,827,000,000 bbl. of reserve oil, as of January 1, 1946 (only slightly more than one-fifth of the world's reserve), produces over 60 per cent of the world's output, while the U.S.S.R. with its four-fifths (or 78 per cent) of the world's total petroleum reserves produces only 11 per cent of the world's petroleum output."

While Russian geologists continue to show interest in potential oil reserves located in Siberia, the probability of any development there—at least in the immediate future—is remote, due to lack of either rail or adequate water transportation. At present there are no rail lines in the far north of Siberia and the rivers are icebound for the greater part of the year.

Russia's total refining capacity—largely distillation—is estimated to be upwards of 275,000,000 bbl., with cracking around 85,000,000 bbl. yearly. In 1945 alone, the U. S. Department of Commerce reports that $3,494,000 worth of "well and refining machinery" was exported to Russia from the U. S. The same source states that last year a total of $45,404,000 worth of mining, well, pumping, and refining machinery was sent from the U. S. to Russia.

During the war the U. S. sent Russia tens of millions of dollars' worth of refining equipment capable of turning out high-octane gasoline. At present Russia is in the market for additional equipment—including geophysical instruments, oil-well-drilling equipment, and refining units. Her ability to obtain this equipment will largely determine how rapidly the Soviet attains Stalin's oil-production goals.

Socony-Vacuum Plans New Venezuelan Pipe Line

NEW YORK.—In about 2 months, Socony-Vacuum Oil Co., S.A., the operating subsidiary of Socony-Vacuum Oil Co., Inc., in Venezuela, hopes to have under way the construction of a 72-mile 12-in. pipe line.

The line will originate in Eastern Venezuela's Guario and Guico fields and will join the Santa Barbara-Puerto La Cruz line, of Cia. Consolidada de Petroleo (Sinclair), about 25 miles from the port.

E. D. Seymour of Socony-Vacuum will be in charge. Williams Brothers Corp. has the contract.

UNIBOLT *Christmas tree* FLOW MANIFOLDS

Make Any Tree Lighter, Safer, Stronger

The UNIBOLT Christmas Tree Flow Manifold is a complete, pre-tested unit which combines all fittings required above the master valve of a tree:

(1) A UNIBOLT Tee (or Cross if double wing tree is desired) with blanking plug tapped for pressure gauge. This fitting is specially designed to facilitate running pressure bombs or paraffin scrapers.

(2) A UNIBOLT Adjustable Wing Valve, instead of the ordinary gate or plug valve, provides a dependable closure for choke changing. Low velocity and, therefore, non-cutting flow thru the adjustable wing valve is assured since the flow is usually thru a small orifice in the positive bean installed beyond the wing valve. The opening in the wing valve is 1-inch. This valve can be completely overhauled "on the job," including replacement of stem and seat.

(3) A UNIBOLT Choke Body, fitted with positive bean and bleeder type blanking plug, provides trouble-free flow control. UNIBOLT "X" Beans or regular fractionally drilled beans are interchangeable in the choke body.

All connections in the flow manifold are standard forged steel UNIBOLT couplings which provide complete interchangeability of any component unit or part thereof, greater strength and less weight and bulk. For extreme abrasive conditions, or for long, trouble-free life, hard chrome stems and seats are available.

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EFFICIENTLY HANDLES THE FLOW OF MUD FROM THE LARGEST MUD PUMPS IN OPERATION. IT THOROUGHLY RECONDITIONS

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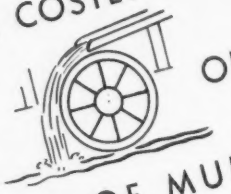

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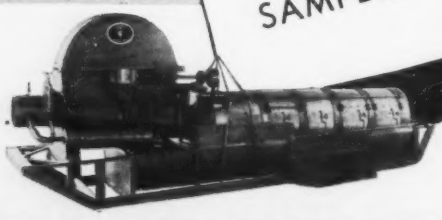
WHICH PROVIDES TRUE SAMPLES OF CUTTINGS.



THOMPSON TOOL CO.

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KEEPS DRILLING MUD *CLEAN* — PROVIDES *TRUE SAMPLES* OF CUTTINGS

SURVEY OF WORLD OIL FIELDS

INTERRUPTED by the war, The Oil and Gas Journal, in this first postwar year resumes its annual survey of oil fields outside the United States. Reports in this survey are based on information obtained directly from the operating companies, and in many instances from the governments of the countries in which the fields are located. Inevitably in the period of reconstruction, information is incomplete in some of the less-important areas. No official information is available on the U.S.S.R. and areas controlled by that country.

ARGENTINA

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
Comodoro Rivadavia area:									
Zone A	1907	1	1,568	2,700	10,700	138,000,000	....	Cretaceous sand	19°
Zone B	1924	2	708	3,300	22,700	101,000,000	....	Cretaceous sand	22°
Zone C	1915	....	422	2,300	2,800	26,000,000	....	Cretaceous sand	21°
Zone D	1919	....	12	3,300	150	1,900,000	....	Cretaceous sand	26°
Zone E	1933	....	...	2,600	.....	30,000	....	Cretaceous sand	..
Zone F	1936	1	208	5,300	5,800	18,300,000	....	Cretaceous sand	24°
Caleta Olivia	1945	8	...	.....	No outlet	.....	....	.....	35°
Plaza Huincul (Neuquen) area:									
Zone 1	1917			2,000				Jurassic sand	32°
Zone 2	1922			2,350				Jurassic sand	31°
Zone 3	1925	78	206	2,600	6,200	17,500,000	....	Jurassic sand	33°
Zone 4	1934			3,400				Jurassic sand	38°
Zone 5	1940			3,400				Jurassic sand	22°
Zone 6	1943			4,000				.....	..
Salta area:									
Agua Blanca	1925			5,000				Permo-Corb. sand	23°
Ramos	1936			3,500				Permo-Corb. sand	53°
Rio Pescado	1934	86	171	4,600	3,700	26,500,000	....	Permo-Corb. sand	23°
San Pedro	1928			3,000				Permo-Corb. sand	45°
Tartogal	1926			1,750				Permo-Corb. sand, Devonian	43°
Mendoza area:									
Cacheuta	1931	...	20	2,000	110	700,000	....	Triassic sand	30°
Lunlunta	1938	13	13	8,200	2,600	3,500,000	....	Triassic sand	27°
Sosneado	1925	....	17	550	700	400,000	....	Tertiary sand	12°
Tupungato	1934	16	12	8,200	6,000	16,500,000	....	Triassic sand	30°
Total		205	3,357		61,460	350,330,000			

ASIA (MISCELLANEOUS)

Japan	....	....	....	.....	4,000	.....	....	.....	...
China	....	....	....	.....	1,000	.....	....	.....	...
Total					5,000				

AUSTRIA

Prinzendorf	1938	....	....	3,200	13,200	17,000,000	....	Miocene sand	31°-34°
Geiselberg	1938	....	....	3,700-4,500	3,800	11,000,000	....	Miocene sand	21°-22°
Kreuzfeld	1943	....	....	2,800-3,000	2,100	2,000,000	....	Miocene sand	..
Zisterdorf	1930	....	....	2,800-4,800	1,100	5,600,000	....	Miocene sand	22°
Total					20,200	35,600,000			

BAHREIN ISLAND

Bahrein Island	1932	62	...	2,000-2,500	23,000	75,000,000	1	Limestone	30°-35°

BOLIVIA

Bermejo	1927	2	3	.....	350	600,000	....	Triassic	26.3°
Sanandita	1926	3	7	2,135	300	1,420,000	....	Triassic	41.8°
Camiri	1927	4	1	3,280	300	1,340,000	....	Devonian	52.7°
Buena Vista	....	1	....	2,500	Shut in	.....	....	Cretaceous	...
Camatindi	....	2	....	2,500	Shut in	.....	....	Cretaceous	...
Saipuri	....	2	....	500	Shut in	.....	....	Devonian	...
Naincoronza	1946	1	....	.....	Shut in	.....	....	.....	...
Total		15	11		950	8,760,000			

BRAZIL

Lobato-Joanes	1939	0	2	1,466-1,733	60	43,462	0	.....	35°
Aratu	1942	0	2	1,500-1,643	30	47,312	0	.....	43°
Candeias	1941	7	9	3,910-3,300	600	105,400	4	Candeias sand	26°
Itaparica	1942	5	8	2,460-2.530	300	52,278	2	.....	34°
Pitanga	1946	0	1	3,930	10	222	1	.....	...
Total		12	22		1,000	248,674	7		

BRITISH ISLES

Midlothian	1938	....	2	1,750	4	15,000	0	Dalkeith	40.0°
Formby	1939	....	9	85-130	8	53,000	1	Keuper	34.4°

(Continued on page 188)

BRITISH ISLES (Continued)

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
Eakring	1939	....	54	1,800-2,500	300	2,410,000	0		34.4°
Dukes Wood	1941	....	112	1,800-2,500	530		0	Sandstones of	
Kelham	1941	....	54	2,000-2,200	260	676,000	0	upper Millstone	28.8°
Caunton	1943	....	10	2,000-2,200	90	107,000	0	grit series	30.6°
Total			241		1,192	3,261,000	1		

BURMA

Status Prior to Japanese Invasion

North Basin:									
Indaw	1918	80		1,100	175	.....	....	.....	...
Central Basin:									
Sabe	1908	....		100-1,800	Small	.....	....	Oligocene	...
Yenangyat	1893	250		500-3,500	500	.....	....	Oligocene	...
Lanywa	1919	80		1,700-3,200	1,800	.....	....	Oligocene	45°
Singu	1902	570		1,400-5,000	9,000	.....	....	Oligocene	...
Yenangyaung	1889	2,875		350-6,000	9,400	.....	....	Mio-Oligocene	45°
Minbo	....	270		450-700	.....	.....	....	.....	...
Palanyon	....	....		2,300	.....	.....	....	.....	...
Yethaya	....	....		600-1,900	.....	.....	....	.....	...
South Basin:									
Yananma	....	....		300-1,200	.....	.....	....	.....	...
Padukpin	1922	....		450-1,800	.....	.....	....	.....	...
Pyaye	1928	4		....	Gas	.....	....	.....	...
Total		4,129			21,000	300,000,000			

CANADA

Turner Valley	1914	380	3,450-9,600	16,500	86,000,000	6	Madison lime	37°-64°
Lloydminster	1940	43	1,750-1,950	1,200	200,000	45	Cretaceous sand	14°
Vermilion	1939	57	1,800-2,000	600	800,000	0	Cretaceous sand	14°
Taber	1937	15	3,200	580	600,000	0	Cretaceous sand	17°-22°
Conrad	1944	19	3,000-3,100	550	350,000	1	Ellis sand	26°
Princess	1940	11	3,200-4,000	200	160,000	2	Limestone	25°-35°
Norman Wells	1920	....	....	650	.....	....	Limestone	...
Ontario fields	1865	1,500	300-3,000	320	.....	....	Limestone	36°-40°
New Brunswick	....	....	1,600-3,150	80	.....	....	.....	...
Total		2,025		20,680	88,110,000	54		

CHILE

Spring Hill	1946	2	....	7,500	No outlet	.....	1	.....	39°

COLOMBIA

Infantas	1918	2	448	400-2,200	8,900	141,670,609	0	A, B, C zones, sand	23.8°
La Cira	1926	14	707	400-3,950	33,300	202,661,687	3	A, B, C zones, sand	24.5°
Casabe	1941	25	23	3,770	10,600	4,343,000	2	Colorado, sand	20.7°
Cantagallo	1943	3	0	1,490-6,870	300	98,398	4	Lisama, sand	20.8°
Floresanto	1943	2	0	600-1,505	288	6,538	2	Pajuil	44.5°-50.3°
El Dificil	1943	14	0	5,900	1,300	55,215	2	Oligocene, lime	45.0°
La Petrolea (N.S.)	1933	90	8	130-1,180	10,200	19,925,618	0	La Luna, Cogollo, Uribante (L.S.S.)	35.0°-46.6°
Carbonera	1939	3	0	800-1,720	.....	.....	0	Los Cuerros, Barco, sand	21.5°
Tibu	1940	29	6	4,200-9,000	4,200	2,159,494	6	Barco, Catatumbo, Uribante, (L.S.S.)	30.8°-49.7°
Rio de Oro	1937	9	0	1,100-1,400	.....	.....	0	Catatumbo, Rio de Oro, sand	30.0°-40.0°
Las Monas	1926	0	0	1,040-3,800	.....	.....	1	Lisama, sand	22°
La Petrolea (S.S.)	1939	2	0	1,350	.....	.....	0	Cogollo, L. sand	37.7°
Galan	1945	2	0	4,380	275	33,083	0	Zona A, sand	20.8°
Colorado	1923	2	2	5,000	275	5,721	3	Zona C, sand	38.1°
Mugrosa	1929	....	....	3,000	.....	68,838	0	.....	30.0°
Velasquez	1946	....	....	8,455	.....	.....	1	.....	...
San Luis	1927	....	....	2,300	.....	7,975	0	.....	...
Total		197	1,194		69,638	371,036,176	24		

CUBA

Jarahueca	1943	....	25	1,500	300	250,000	....	.....	45°
Montembo	1880	....	200	600-1,800	200	1,000,000	....	Eocene Serpentine	60°
Baroraneo	1916	....	....	400-1,200	2	145,000	....	Cretaceous sand	20°
Total			225		502	1,395,000			

EAST INDIES

Pre-Japanese Invasion Status

Borneo	1911-1919	1,400	150-6,000	50,000	522,000,000	....	Tertiary sands	18°-38°
Sumatra	1893-1938	1,600	150-5,700	112,000	543,000,000	....	Tertiary sands	20°-62°
Java	1889-1914	335	300-2,700	17,000	119,000,000	....	Tertiary sands	23°-40°
Ceram	1913	50	120-500	1,500	8,200,000	....	Tertiary sands	24°
Total		3,385		180,500	1,192,200,000			

HOUDRY LICENSEES get the benefit of HOUDRY RESEARCH

Houdry Laboratories, with unexcelled physical equipment for catalytic research, are staffed by scores of top-flight chemical engineers, mechanical engineers, process engineers, metallurgists, economists and specialists in refinery operation. Their research is for the benefit of Houdry licensees, helping them to attain the optimum in quality and volume of output at the minimum operating cost.

A large proportion of royalties received from Houdry licensees is reinvested in such research for their common benefit. New processes, improvements in existing processes and catalyst research are the subjects of searching inquiry which inevitably will serve to keep Houdry licensees abreast or ahead of major developments in refining techniques.

There is more catalytic "know how" in Houdry Laboratories than can be found in any similar scientific organization, regardless of size or sponsorship.

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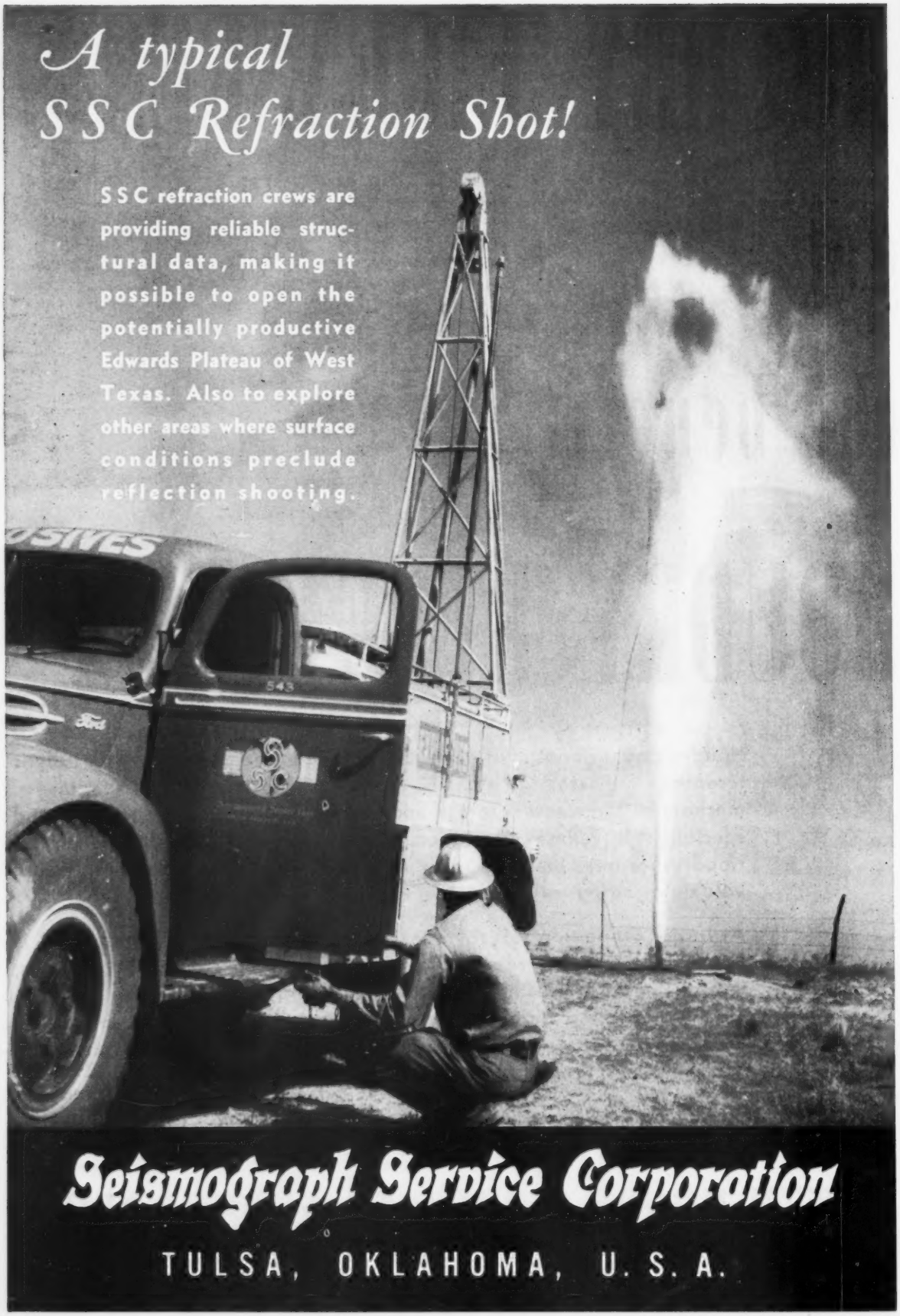
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ECUADOR

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
El Tambo	1931	....	6	1,200	10	.....	....	Eocene sand	39°
Concepcion	1930	....	10	3,000-4,000	30	.....	....	Eocene sand	38°
Cautivo	1920	....	28	500-1,200	30	.....	....	Eocene sand	35°
Ancon	1920	39	414	1,200-1,800	4,750	32,000,000	....	Eocene sand	38°-41°
Carolina	1923	....	15	30-600	95	.....	....	Eocene sand	18°-28°
Santa Rita	1932	....	34	500-1,200	165	.....	....	Eocene sand	28°
Tigre	1936	10	5	2,850-4,300	920	3,000,000	....	Eocene sand	39°
Total		49	512		6,000	35,000,000			

EGYPT

Hurghada	1913	....	62	1,700-2,200	1,000	40,000,000	....	Pre-Miocene, Nubian sands	22°-24°
Ras Gharib	1938	25	13 G.L.	1,500-2,400	24,000	55,000,000	1	Basal Miocene limestone, Pre-Miocene sands	25°-26°
Sudr	1946	....	....	2,675-2,826	Discovery	.....	1	Sand, Basal Miocene	..
Gemsa	1908	1	....	1,240-1,310	Suspended	1,418,000	....	Limestone, Basal Miocene	39°
Abu-Durba	1918	....	27	300-1,500	Suspended	77,090	....	Nubian S.S.	13°
Total		26	102		25,000	96,495,192	2		

EUROPEAN MISCELLANEOUS

Germany	....	....	....	....	13,000	.....	....	.....	..
Poland	....	....	....	....	2,000	.....	....	.....	..
Albania	....	....	....	....	3,000	.....	....	.....	..
Total					16,000				

FRANCE

Pechelbronn	1882	....	750	100-2,000	1,062	18,000,000	30	Sand, Tertiary and Jurassic	14°-35°
St. Marcet	1939	1	....	5,900	18	15,000	2	Cret. lime	32°
Total		1	750		1,080	18,015,000	32		

HOLLAND (NETHERLANDS)

Schoonebeck	1943	1	7	2,500	900	164,000	3	Cretaceous	24.8°

HUNGARY

Budafa	1936	41	37	3,300-3,900	4,320	13,016,000	....	Lower Pannonian, Pli.	41°
Lovaszi	1940	54	28	4,400-4,900	8,910	14,416,000	6	Lower Pannonian, Pli.	42°
Hahot	1942	4	....	3,800-4,200	1,720	1,917,000	....	Lower Pannonian, Pli.	32°
Ujfalu	1941	....	....	2,000	.....	13,000	1	Lower Pannonian, Pli.	40°
Total		99	65		14,950	29,362,000	7		

INDIA

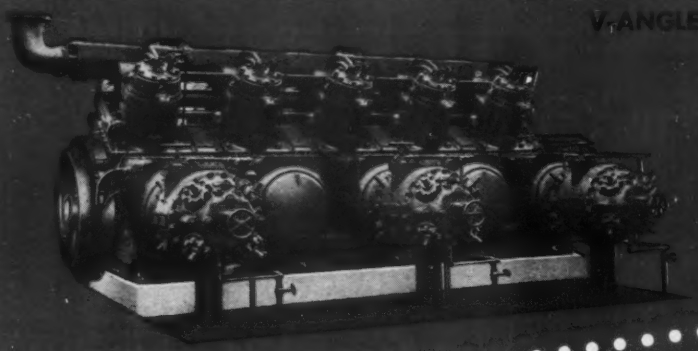
North Central India:									
Dhulian	1937	....	....	7,000	650	.....	....	Eocene lime	40°-45°
Khaur	....	....	....	500-5,000	250	.....	....	Miocene sands	35°-42°
Jaya Mair	1944	2	....	7,000	Shut in	.....	1	Eocene lime	19°
Northeast India:									
Digboi	....	207		500-5,600	6,000	.....	....	Miocene sand	37°
Total		209			6,900		1		

IRAN

Masjid-i-Sulaiman	1908	27	....	2,000-3,000	100,000	754,100,000	0	Asmari lime	38.0°
Haft Kel	1928	23	....	3,000-4,000	200,000	654,000,000	1	Asmari lime	39.0°
White Oil Springs	1934	1	....	5,700			1	Asmari lime	34.0°
Gach Saran	1928	3	....	4,000-7,000	40,000	56,100,000	0	Asmari lime	31.1°
Agha Jari	1937	8	....	6,000-9,000	80,000	32,500,000	4	Asmari lime	36.0°
Pazanun	1937	....	....	6,000-8,000	Shut in	6,400,000	0	Asmari lime	66.4°
Naft-i-Shah	1923	2	....	2,600-2,700	2,000	8,200,000	0	Kalhur limestone	43.0°
Total		64			422,000	1,511,300,000	6		

IRAQ

Naft Khaneh	1926	1	....	3,000	6,000	22,300,000	0	Kalhur limestone	43°
Kirkuk	1927	10	....	2,750	90,000	308,000,000	2	Quarah Chauk lime	36°
Total		11			96,000	330,300,000	2		



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200 to 1000 bhp

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400 to 1650 bhp

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DIESEL, GAS, GAS-DIESEL
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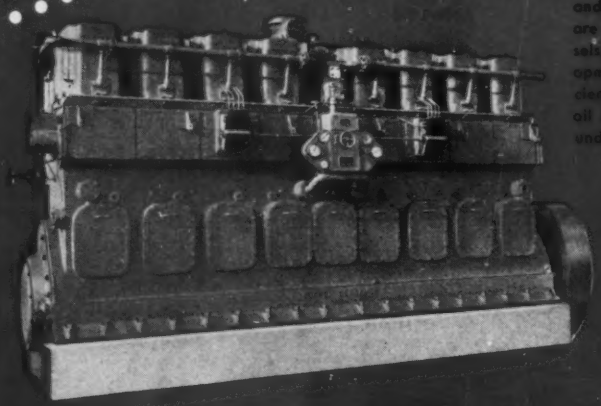

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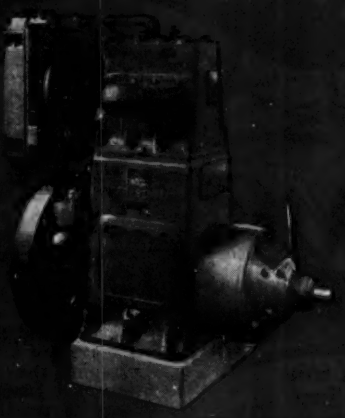

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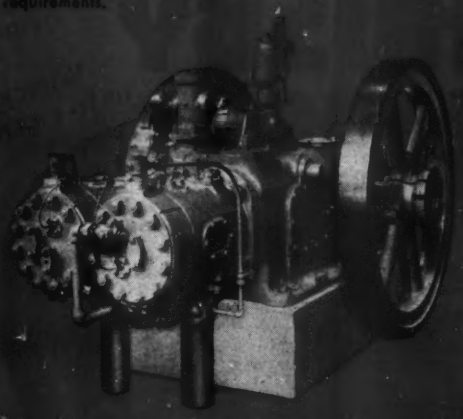

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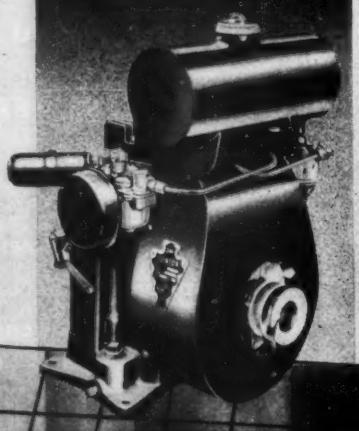

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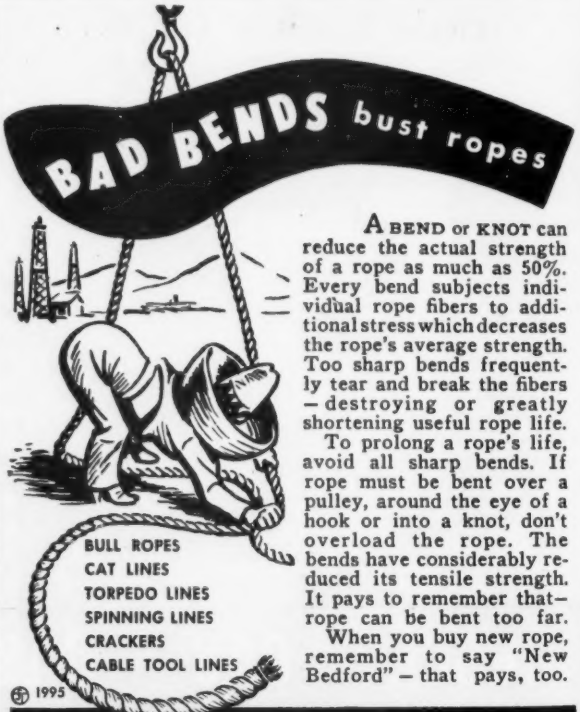

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To prolong a rope's life, avoid all sharp bends. If rope must be bent over a pulley, around the eye of a hook or into a knot, don't overload the rope. The bends have considerably reduced its tensile strength. It pays to remember that—rope can be bent too far.

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ITALY

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
Valleza	1909	....	149	1,600-2,400	94	840,000	3	Tongrian, Olig.	50°
Centopozzi-Salsominore	1923	....	63	500-1,600	19	483,000	....	Tongrian, Olig.	40°-43°
Vizzola	1942	2	1	1,900	4	13,000	1	Piacentian, Pli.	31°
Montechima-Velleja	1899	2	213	100-3,000	117	1,336,000	4	Eocene	42°-59°
Bando & Malalbergo	....	3	....	1,030-1,170	Gas	.....	1	Piacentian, Pli.	..
Gallo	....	....	....	.....	.....	.....	1	.....	..
Total		7	426		234	2,672,000	10		

KUWAIT

Burgan	1938	5	.	3,800-4,400	40,000	.....	....	Middle Cretaceous sandstones	31°-33°

MEXICO

Northern area:									
Mision	1945	3	....	6,100	30	7,000	...	Vicksburg	Distillate
La Presa	1931	3	....	1,350	Gas	Gas	....	Mt. Selman	Distillate
Laredo	1937	3	....	730	Gas	Gas	....	Mt. Selman	Distillate
Mier	1936	7	....	2,120	Gas	Gas	....	Mt. Selman	Distillate
Rancherias	1933	7	....	1,750	Gas	Gas	...	Cockfield	Distillate
Tampico area:									
Poza Rica	1930	68	....	7,550	68,500	248,000,000	....	Tamabra lime	30°
North district	1901	551	1,112	1,150	20,600	776,000,000	....	Tamal. lime	12°
Golden Lane	1908	225	319	2,200	23,600	1,100,000,000	....	El Abra lime	20°
Miscellaneous	....	1	54	Various	70	4,000,000	....	.....	..
Tehuantepec area:									
Cuichapa	1934	8	90	2,130	1,200	1,460,000	....	Miocene sand	30°
El Burro	1930	0	217	2,520	1,800	15,830,000	....	Miocene sand	26°
El Plan	1931	28	1,543	2,200-5,900	10,300	55,390,000	....	Miocene sand	24°-35°
Filisola	1921	0	38	1,675	700	20,650,000	....	Miocene sand	22°
Teapa Nuevo	1928	0	....	450	.....	200,000	....	Miocene sand	36°
Tomala	1928	0	278	1,800	1,800	64,060,000	....	Miocene sand	28°
Miscellaneous	....	0	0	.....	.....	380,000	....	.....	..
Total		904	3,651		128,600	2,285,977,000			

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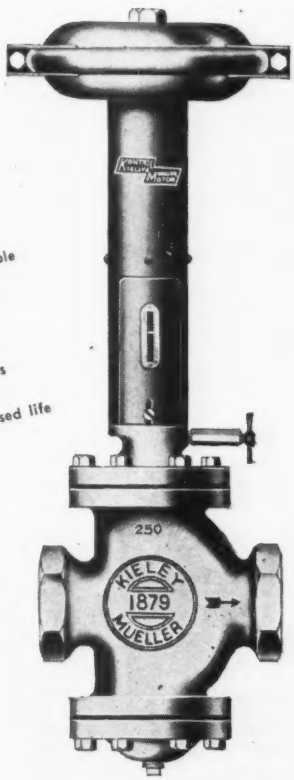

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PERU

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
La Brea-Parinas	1888	172	1,874	1,500-5,000	27,000	273,536,000	22	Tertiary	34.4°-37.6°
Lobitos	1904	80	709	3,000-6,300	4,200	61,500,000	8	Eocene	26°-45°
Zorritos	1883	....	50	300-1,700	300	3,700,000	....	Miocene	38°
Agua Caliente	1939	5	....	1,000-1,100	500	300,000	2	Cretaceous	44.5°
Total		257	2,633		32,000	339,036,000	32		

QATAR

Dukhan	1940	2	....	5,800-6,000	Shut in	.....	0	Kerkrit lime	36°

ROMANIA

Ceptura	1913	....	....	2,400-4,100	.....	.....	....	Meotic, Pli.	34°
Bucsani	1933	....	....	6,500-7,300	.....	.....	....	Meotic, Pli.	38°
Margineni	1935	....	....	6,100-7,500	.....	.....	....	Meotic & Helvetian, Pli.	39°
Pitigaia	1938	....	....	4,400-4,600	.....	.....	....	Meotic, Pli.	36°
Baicoi	1861	....	....	600-8,800	.....	.....	....	Dacic & Meotic, Pli.	39°
Boldesti	1922	....	....	6,900-7,900	.....	.....	....	Meotic, Pli.	37°
Calinesti	1934	....	....	5,300-5,700	.....	.....	....	Meotic, Pli.	33°
Pacureti	1899	....	....	2,000-4,000	.....	.....	....	Dacic, Pontic & Meotic, Pli.	52°
West Gura Ocnetei	1929	....	....	5,400-5,900	.....	.....	....	Meotic, Pli.	33°
Aricesti	1921	....	....	5,500-7,400	.....	.....	....	Meotic, Pli.	35°
Moreni	1903	....	....	1,400-5,600	.....	.....	....	Dacic & Meotic, Pli.	33°
Piscuri	1927	....	....	1,200-4,000	.....	.....	....	Dacic & Meotic, Pli.	33°
Bustanari-Runcu	1844	....	....	100-2,500	.....	.....	....	Meotic, Pli.	42°
Ditesti-Floresti	1933	....	....	6,900-7,300	.....	.....	....	Meotic, Pli.	39°
Miscellaneous	....	....	....	.....	.....	.....	....	.....	..

SAUDI ARABIA

Dammam	1935	31	....	4,700	100,000	67,000,000	1	Limestone	35°
Abu Hadriya	1940	1	....	10,200	Shut in	10,000	0	Limestone	35°
Abqaiq	1940	6	....	6,500	70,000	7,000,000	4	Limestone	27°-37°
Qatif	1945	1	....	7,500	3,000	500,000	0	Limestone	31°-38°
Total		39			173,000	74,510,000	5		

TRINIDAD, BRITISH WEST INDIES

Forest Reserve	1913	145	186	0-8,000	14,500	32,001,820	3	Miocene sand	14.8°-33.2°
Barrackpore	1913	4	49	0-6,000	650	5,566,383	2	Miocene sand & Oligocene	17.3°-30.6°
Guayaguayare	1907	29	43	0-5,000	1,300	6,539,289	1	Miocene	15.3°-49.9°
Quinam	1938	1	10	1,000-4,300	150	932,408	....	Miocene	25.9°-34.1°
Wilson	1937	1	31	2,500-4,500	250	2,198,702	1	Miocene	12.2°-25.7°
Cruse	1913	42	40	1,800-4,000	2,600	11,981,741	....	Miocene	13.2°-30.5°
Palo Seco	1928	26	7	1,500-5,500	800	3,221,036	1	Miocene	30.0°
Morne Diablo	1938	5	18	1,000-4,700	450	1,790,236	....	Miocene	20.0°-33.2°
Fyzabad	1920	76	174	300-8,000	9,000	75,900,000	3	Miocene	24.0°
Point Fortin	1908	96	56	1,800-6,800	7,629	27,000,000	2	Miocene	22.1°
Parrylands	1913	18	12	2,000-4,000	1,159	19,000,000	1	Miocene	20.6°
San Francique	1922	....	16	1,000-2,800	324	4,000,000	....	Miocene	22.8°
Pinal	1935	19	30	1,300-8,500	4,845	7,000,000	2	Miocene-Olig.	22.8°
Brighton	1910	16	29	700-3,000	4,353	.....	....	Miocene	18.0°
Coora-Quarry	....	105	107	1,200-6,500	850	.....	....	Miocene	26.0°
Guapo	....	199	119	1,500-5,700	6,140	.....	....	Miocene	16°-24°
Total		782	927		55,000	197,131,615	16		

VENEZUELA

Cabimas	1917	186	744	2,099	81,192	516,397,159	4	Lagunillas, La Rosa, Icotea, Mio-Oligocene	24.3°
Lagunillas	1926	228	1,030	2,998	325,842	1,358,019,009	1	Bachaquero, Lagunillas, La Rosa, Mio-Eocene	21.0°
Tia Juana	1928	213	316	2,998	174,433	394,699,009	6	Bachaquero, Lagunillas, La Rosa, Mio-Eocene	21.4°
Bachaquero	1930	171	3	3,444	50,716	44,251,370	7	Bachaquero, Lagunillas, La Rosa, Mio-Eocene	14.2°
Pueblo Viejo	1940	11	1	1,968	6,962	3,365,900	3	Eocene	20.8°
La Concepcion	1925	3	95	3,149	3,160	29,770,541	1	Ramillete, Punta Gorda, Eocene	36.7°
La Paz	1925	14	2	4,264	39,869	26,571,773	3	La Paz, Eocene, La Luna, Cogollo, Cretaceous	34.2°
Mene Grande	1914	69	196	4,133	35,617	286,529,997	1	Tertiary Joven, Pauji, Eocene	21.7°
El Cubo	1916	33	91	820	15,081	98,300,487	3	Mirador, Eocene	30.8°
Cumarebo	1931	33	18	1,968	4,812	35,376,427	0	Damsite & Socorro, Miocene	47.7°
Mene de Mauroa	1921	10	10	984	456	24,405,869	0	Agua Clara, Oligocene	32.3°

(Continued on page 197)

VENEZUELA (Continued)

Name of field—	Year of discovery	No. of prod. wells: Flowing	No. of prod. wells: Pumping	Producing depths	Daily average production (bbl.)	Accumulative production (bbl.)	Wells drilling	Name and type of formation	Gravity A.P.I.
Hombre Pintado	1927	0	18	1,968	637	3,610,460	0	Agua Clara, Oligocene	24.3°
Netick	1929	1	0	.....	276	386,073	0	Horqueta, Eocene	29.2°
Mara	1945	2	0	5,248	5,999	2,403,941	1	Cogollo, Cretaceous	29.5°
Amana	1928	0	0	3,280	21	33,298	1	.....	31.5°
Quiriquire	1928	29	213	3,280	50,003	250,986,928	2	Quiriquire, Pliocene	19.6°
Temblador	1936	64	0	3,805	6,144	21,508,148	0	Oficina, Mio-Oligocene	21.6°
Oficina	1937	112	20	5,117	34,800	101,647,046	2	Oficina, Mio-Oligocene	31.6°
Jusepin	1938	285	0	4,264	55,293	66,015,323	6	La Pica, Miocene, Caripita, Oligocene	32.8°
San Joaquin	1939	28	0	6,560	9,907	16,150,488	2	Oficina, Mio-Oligocene	43.7°
El Roble	1939	10	0	9,446	3,935	11,272,085	1	Oficina, Mio-Oligocene	56.5°
Guario	1940	10	0	5,248	5,246	3,765,031	1	Oficina, Mio-Oligocene, Merecure, Eocene	43.3°
Quiamare	1942	1	0	6,396	175	504,799	0	.....	38.7°
Santa Rosa	1941	4	0	7,380	1,489	2,462,606	1	Oficina, Mio-Oligocene, Merecure, Eocene	45.7°
Los Caritos	1939	1	0	5,642	251	141,350	0	Oficina, Mio-Oligocene	30.5°
La Ceiba	1945	1	0	.....	172	17,750	1	.....	36.6°
Santa Ana	1936	2	0	8,266	579	864,788	2	Oficina, Mio-Oligocene, Merecure, Eocene	36.9°
Nipa	1946	2	0	7,544	1,849	158,785	3	.....	37.3°
Pirital	1945	1	0	2,460	73	48,268	..	.....	32.5°
Las Mercedes	1942	0	0	4,264	112	64,043	3	La Pascua, Mio-Oligocene & Cretaceous	30.1°
Leona	1938	17	0	5,904	5,136	4,535,007	..	Oficina, Mio-Oligocene	28.8°
Sta. Barbara	1941	233	0	5,642	38,212	37,750,807	9	La Pica, Miocene	31.9°
Tucupita	1945	1	0	5,609	87	33,172	1	.....	16.2°
Guico	1944	33	0	6,068	16,163	5,490,670	2	Oficina, Mio-Oligocene	38.4°
Rincon Largo	1936	4	0	7,708	2,219	1,318,111	.	Mio-Oligocene	42.0°
Mulata	1941	145	0	4,592	28,797	24,035,426	4	La Pica, Miocene	33.5°
Guara	1942	133	0	4,920	72,894	42,236,609	5	Oficina, Mio-Oligocene	38.3°
Merey	1934	0	0	4,494	0	62,936	0	Miocene	...
Areo	1934	0	0	.....	0	4,063	0	.....	...
Yopales	1937	0	0	4,166	0	167,459	0	Oficina, Mio-Oligocene	29.7°
Socorro	1939	0	0	3,936	0	12,234	0	Pleistocene	27.3°
Las Ollas	1940	0	0	.....	0	4,648	0	.....	24.0°
Anaco	1940	0	0	11,152	0	7,504	0	.....	47.1°
Orocual	1933	0	0	3,182	0	29,531	0	Mio-Pliocene	...
El Totumo	1928	0	0	.....	0	24,260	0	.....	...
Las Palmas	1929	0	0	.....	0	433,963	0	.....	31.3°
Mene de Acosta	1929	0	0	2,624	0	778,077	0	Oligocene	...
Capacho	1945	0	0	4,428	0	7,032	0	.....	23.1°
Tabasca	1945	0	0	4,198	0	45,041	0	Miocene	15.8°
Pedernales	1936	0	0	1,571	0	9,036,024	0	La Pica, Miocene	20.6°
Guanoco	1913	0	0	459	0	1,718,940	0	Cretaceous	...
Total		2,090	2,757		1,078,606	3,427,460,265	76		

SURVEY OF WORLD OIL REFINERIES

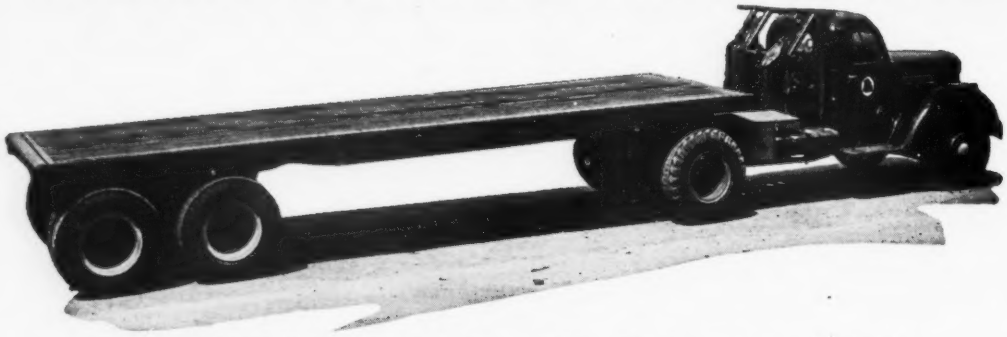
IN this issue The Oil and Gas Journal resumes its prewar feature of a survey covering refinery operations outside the United States and Canada. Detailed reports on these two countries are part of the Journal's Annual Refinery Number, the latest issue of which was published March 30, 1946. The next refinery survey of United States and Canada will be published as the Annual Refinery Number, March 22, 1947. The report on refinery operations in this issue is based largely on information obtained directly from the operating companies and the governments in which the refineries are located. No detailed information was available on refinery operations of the U.S.S.R. and only partial data on plants in countries controlled by the U.S.S.R. American and British occupation forces in Germany and Japan have not made available information covering the present status of prewar refining facilities in those countries. These abbreviations are used in the following tables: Skimming (S); cracking, thermal or catalytic (C); lubricating oil (L); asphalt (A); wax (W).

ARGENTINA

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
Cia. Ferrocarrilera de Petroleo, Paseo Colon 185, Buenos Aires	Comodoro Rivadavia	8,000	S-C	2,000
Cia. Nativa de Petroleos, Av. Roque Saenz Pena 567, Buenos Aires	Compana	16,000	S-C-A-L	8,000
Cia. Nativa de Petroleos, Av. Roque Saenz Pena 567, Buenos Aires	Bahia Blanca	3,000	S-C	1,850

(Continued on page 199)

A RUGGED-DUTY OIL FIELD TRAILER



Our Model S-F 42-T tandem platform, illustrated above, is constructed to handle the extreme load weights common to oil field hauling.

Embodying three-point suspension, this trailer distributes load weights evenly over the tandem axle assembly. Construction of frame at center and sides is specially engineered to withstand the stress of maximum loads. The roll type tail board permits rear loading.

This equipment is tried and proven, being used currently throughout the entire Mid-Continent area by oil field truck operators and producers.

Prompt delivery of this model is assured.

AMERICAN BODY & TRAILER COMPANY

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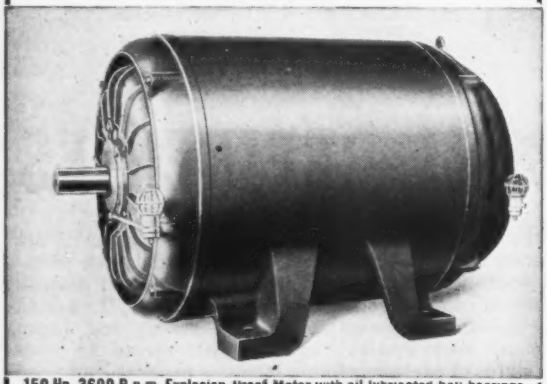
Continental
EXPLOSION-PROOF MOTORS
1 to 600 Hp.



150 Hp. 3600 R.p.m. Explosion-Proof Motor with oil lubricated ball bearings

CONTINENTAL ELECTRIC CO., Inc.
Plants—Newark 5, N. J., Rockford, Ill.

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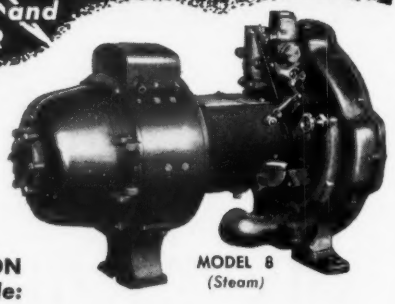
ELECTRIC MOTORS

MOON Generators
TURBO and BELT DRIVEN
for LIGHT and POWER

HERE'S your ideal small power plant for lights, ventilating fans, or other electrical equipment.



MODEL 8
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Important MOON features include:

- **GOVERNOR AND COMPOUND WINDING** on Steam-driven models prevent excess voltage output which might injure electrical apparatus . . .
- **ONLY 2 EASY-TO-REACH OILING POINTS** . . .
- **AUTOMATIC CUT-OFF** on larger capacity Steam-driven models prevents overload damage to generator . . . . . .

MODELS FROM 1 TO 7½ KW CAPACITY . . . SEND FOR ILLUSTRATED CIRCULARS TODAY

Send in your old MOON Generators for re-building now — we can give prompt service.

MOON MFG. CO.
116 North Jefferson St., Chicago 6, Illinois, U.S.A.

ESTABLISHED 1893

ARGENTINA (Continued)

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
Diadema Argentina S.A. de Petroleo (Shell), Av. Roque Saenz Pena 788, Buenos Aires	Buenos Aires	15,125	S-C	9,000
Cia. El Condor, Levalle 27, Avellaneda	Avellaneda, Buenos Aires	1,300	S-L	None
Cia. Ultramar, S.A., Petroleo Argentina, Calle Chile 778, Buenos Aires	Buenos Aires	6,500	Comp.	26,000
Standard Oil Co., S.A., Buenos Aires	Embarcacion F.C.C.N.A.	1,000	S	None
Standard Oil Co., S.A., Buenos Aires	Plaza Huincul F.S.S.	350	S	None
Yacimiento Petroliferos Fiscales, R.S. Pena 777, Buenos Aires	La Plata	30,000	Comp.	24,000
Yacimiento Petroliferos Fiscales, R.S. Pena 777, Buenos Aires	San Lorenzo	7,500	S-C	7,550
Yacimiento Petroliferos Fiscales, R.S. Pena 777, Buenos Aires	Compana	3,000	S-C	1,000
Yacimiento Petroliferos Fiscales, R.S. Pena 777, Buenos Aires	Godoy Cruz	650	S	None
Yacimiento Petroliferos Fiscales, R.S. Pena 777, Buenos Aires	Plaza Huincul	1,575	S	None
Total Argentina		94,000		56,000

AUSTRALIA

Commonwealth Oil Refineries, Ltd. (Anglo-Iranian), Melbourne	Laverton, Victoria	2,500	S	None
Shell Co. of Australia, Ltd., Shell Corner, 163 William St., Melbourne, C. I., Victoria	Clyde, N.S.W.	5,000	S-C	None
Total Australia		7,500		None

AUSTRIA

Following is a list of prewar refinery operations with changes made in two plants to conform to recent information. It is expected that most of these plants will be returned to normal operation during the coming year.

Creditul Minier Oesterreichlische—Rumanische, Petroleum-Vertriebs-Gesellschaft, Bulevardul Bratianu 16, Bucharest	Korneuburg	2,400	....	None
Creditul Minier Oesterreischische—Rumanische, Petroleum-Vertriebs-Gesellschaft, Bulevardul Bratianu 16, Bucharest	Droesing	1,000	....	None
Oesterreichische Fanto, A.G., Herrengasse 17, Vienna	Lanzendorf	1,120	....	None
Aktien Gesellschaft der Shell-Floridsdorfer-Mineralolfabrik, Schuberting 14, Vienna 1	Floridsdorfer	2,500	L-W-A	None
Vacuum Oil Co., A.G. (Vienna), Schwarzenbergplatz 18, Vienna	Kagran	1,500	....	None
Total Austria		8,020		750

BAHREIN ISLAND

Bahrein Petroleum Co., 135 East Forty-second St., New York	Bahrein I., Persian G.	110,000	S-C-A	29,000

BELGIUM

Belgian Shell Co., 47 Canterstun, Brussels	Ghent	4,000	S-L-A	None
Belgo Petroleum Co., Terdonck	Terdonck	1,200	S-C	1,000
Raffinerie Belge de Petroles, Antwerp	Antwerp	3,800	S-C	1,000
Raffineries et Distilleries Anversoises, Antwerp	Antwerp	2,000	S	None
Redeventza Societe Anon. Belge, Antwerp-Kiel	Antwerp-Kiel	3,000	S-C	1,000
Compagnie Industrielle Atlas S.A. Belge, Antwerp	Antwerp	1,500	S	None
Total Belgium		15,500		3,000

Note.—Most of these plants are undergoing repair and are now shut down.

BOLIVIA

Yacimientos Petroliferos Fiscales Bolivianos, La Paz	Camiri	500	S	None
Yacimientos Petroliferos Fiscales Bolivianos, La Paz	Sanadita	500		None
Total Bolivia		1,000		

BRAZIL

Industrias Matarazzo de Energia S.A. "IME" Predio Conde Matarazzo, Sao Paulo	Sao Caetano	3,500	S	None
Ipiranga S.A. Companhia Brasileira de Petroleas, Saco de Mangueira sem numero, Rio Grande	Rio Grande	2,250	S	None
Conselho Nacional do Petroleo, Avenida Presidente Wilson, Rio de Janeiro	Bahia (2 plants)	250	S	None
Total Brazil		6,000		

CANADA

Detailed information on Canadian refineries appeared in the Annual Refining Number of The Oil and Gas Journal, March 30, 1946. Total of 33 operating refineries had a capacity of		245,000		78,000

CANARY ISLANDS (Spain)

Compania Espanola de Petroleos, S.A., Madrid	Santa Cruz de Teneriffe	5,000	S-C	4,100

COLOMBIA

Tropical Oil Co., Apt. 170, Via Cartagena, El Centro	Barranca Bermeja	16,200	S-L-A	None
Colombian Petroleum Co., 135 East Forty-second St., New York	Petrolea	800	S	None
Total Colombia		17,000		

CHILE

Cia. de Salitre Y.P.C. de Agua Santa, Iquique	Iquique	300	S	None
Soc. Establecimientos Fuimicos, Ave. Vina Del Mar	Del Mar	200	S	None

CUBA

Standard Oil Co. of Cuba, Belot P.O. 1169, Havana	Belot	3,500	S-C-L-A	2,000
Cia. Cubana de Petroleo, S.A., Havana	Havana	500	S	None
Total Cuba		4,000		2,000

DENMARK

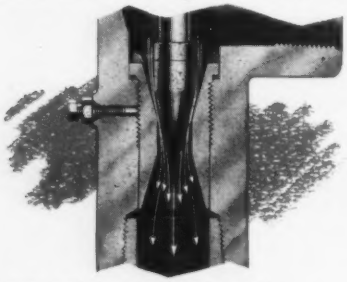
A/S Kalundborg Olieraffinaderi, Ostre Hauneveg, Kalundborg	Kalundborg	350	A	None

All adjustable Flow Beans alike?

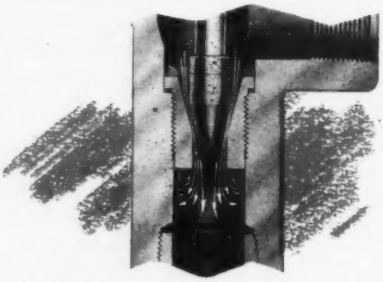
NOT AT ALL!

Look at the plus features you get in Shaffer Flow Beans!

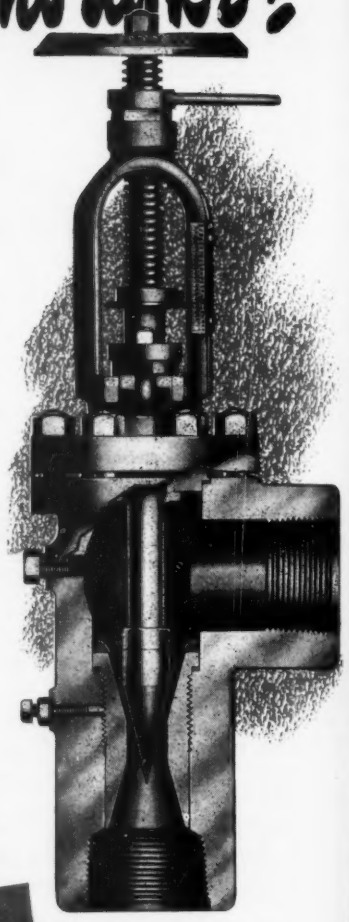
ONE adjustable flow bean may look like another . . . but don't be fooled. The spot where the work is done is in the orifice . . . and here's where Shaffer—the organization that *pioneered* adjustable flow beans—has engineered extra performance and higher flow efficiency into Shaffer Adjustable Flow Beans. Notice how the orifice tapers at *both* the entrance and discharge sides. This important feature permits the fluid to flow through the orifice with less turbulence and emulsification. Here's why:



IN THE SHAFFER FLOW BEAN the fluid is guided into the orifice by the tapered inlet . . . then on the discharge side is guided out again by the tapered outlet. This controls the fluid flow, bringing it gradually to the full diameter of the discharge pipe, ***without the turbulence and emulsification caused by a straight orifice tube.***



IN ORDINARY FLOW BEANS the discharge side is a straight tube without the taper characteristics of Shaffer Flow Beans. Fluid emerging from this straight bore is not controlled as it flows into the discharge line. This uncontrolled flow causes eddy currents, increases flow turbulence, and tends to emulsify the fluid.



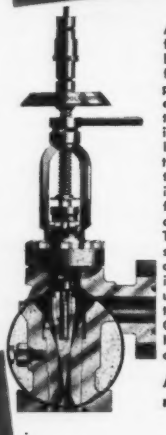
This Shaffer advantage is important. Less emulsification means less treating costs for separating water from the oil . . . and greater handling efficiency in your production and refining operations. And here's another advantage . . . the Shaffer Adjustable Flow Bean may be connected in the hook-up so that the flow is either toward or against the tip —an advantage that is not practical with the straight discharge type of orifice. This feature greatly facilitates hook-ups, and permits wider versatility in installing Shaffer Flow Beans than with conventional types.

FLANGED OR THREADED CONNECTIONS... WIDE RANGE OF SIZES

There is a Shaffer Adjustable Flow Bean to fit every requirement . . . whether flanged or threaded connections . . . bolted or threaded yokes . . . and in sizes from 1" to 6" pipe. Pressure test ratings up to 10,000 lbs. per square inch. See your Shaffer representative for complete information on these Flow Beans . . . or write direct!

Send for complete Shaffer Catalog.

Other Shaffer Features . . .

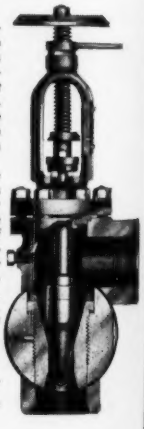


THERMO TIP

And here's a unique Shaffer development that is a big help in handling waxy fluids—or where rapid expansion of gas in the crude oil causes ice to form at the orifice. It's a tip which incorporates an electrically heated element that heats the fluid as it passes through the orifice, thus preventing ice from forming or wax from clogging the orifice and choking the fluid flow. The unit operates from any standard 110-volt circuit, and the tip in the 2" size is heated to about 850° F. under atmospheric conditions.
On larger sizes greater heat can be obtained if desired.

MICRO TIP

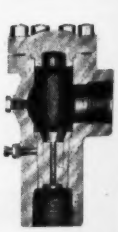
Often it is desired to secure an equal increase in opening area for each turn or fractional turn of the adjusting screw throughout the entire travel of the tip. You get this feature in the Shaffer Micro Tip with which any Shaffer Flow Bean can be furnished.
The advantage of this tip is that very small openings can be secured with great accuracy—and the increase or decrease in the size of the opening will be absolutely uniform throughout the entire travel of the adjusting screw. In addition, this tip provides a flow pattern that duplicates that of an almost perfect venturi tube.



Also where sand is a problem, special abrasion-resisting tips are available to minimize wear.

INTERCHANGEABLE POSITIVE CHOKE

Here's a way to cut hook-up costs. Use the Shaffer Adjustable Flow Bean to determine the proper size orifice for pro-ration purposes. With this determined, the yoke, stem and tip can then be replaced with an insert and fixed choke having the proper size hole. A blanking off cap is substituted for the yoke—and you have a positive fixed-diameter choke, while the yoke, stem and adjustable tip are salvageable for other applications.



For helpful information on Shaffer equipment, see Pages 2687 to 2730 of your Composite Catalog.

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HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

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ECUADOR

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
Anglo-Ecuadorian Oilfields, Ltd., 146 Dashwood House, Old Broad St., E.C. 2, London, England	La Libertad	1,500	S	None
Ecuador Oilfields, Ltd., River Plate House, Finsbury Circus, E.C. 2, London, England; Apartado 865, Guayaquil, Ecuador	Cuativo	500	S	None
Total Ecuador		2,000		

EGYPT

Anglo-Egyptian Oilfields, Ltd., St. Helen's Court, Great St. Helen's E.C. 3, London, England	Suez	35,000	S-C-A	4,000
Raffinerie de Petrole du Government, 18 Rue Fouad Ier Alexandria	Suez.	1,750	S	None
Total Egypt		36,750		4,000

FRANCE

Except for plants in the Mediterranean area French refining industry was badly damaged during war period with four plants completely destroyed. Present crude runs to still about one-fourth prewar. Some plants listed below are shut down but are being repaired for future operation. Nine plants are operating.

Compagnie Francaise de Raffinage, 11 Rue du Docteur Lancereaux, Paris 8	Gonfreville	36,000	Comp.	8,800
Compagnie Francaise de Raffinage, 11 Rue du Docteur Lancereaux, Paris 8	Martigues	20,000	S-C	5,900
Compagnie Industrielle des Petroles, S.A.F., 54 Rue de Londres, Paris	Frontignan-Sete	4,000	A-L	None
Raffineries de la Vacuum Oil Co., S.A.F., 46 Rue de Courcelles, Paris	Gravenchon	4,000	L-W-A	2,300
Compagnie des Produits Chimiques et Raffineries de Berre, 55 Rue d'Amsterdam, Paris 8	Berre	10,000	Comp.	4,500
Les Propetrol Consommateurs de Petrole, Paris	Donges	3,500	S-L	None
Pechelbronn Societe Anonyme d'Exploitations Minieres, 32 Allee de la Robert sau, Strasbourg	Merkwiller-Pechelbronn	1,500	S	None
Raffineries de la Vacuum Oil Co., S.A.F., 46 Rue de Courcelles, Paris	Port Jerome	6,500	S-C	2,300
Societe Anon. des Petroles "Jupiter" (Shell), 42 Rue Washington, Paris 8	Pauillac	10,000	S-C	4,000
Societe Anon. des Petroles "Jupiter," 42 Rue Washington, Paris 8	Rouen	15,000	S-C	4,000
Societe de Raffinage des Huiles de Petrole (subsidiary of Anglo-Iranian) 19-21 Rue de la Bienfaisance, Paris 8e	Courcheletts	5,200	L-W-A	2,000
Societe de Raffinage des Huiles, 1920 Rue de la Bienfaisance, Paris 8e	L'Avera	15,600	L-W-A	7,300
Societe des Raffineries de Petrole de la Gironde (Texas Co. interested), No. 7 Place Vendome, Paris	Bordeaux	6,300	S-C	5,000
Standard Francaise des Petroles S.A., 82 Ave. des Champs Elysees, Paris	Port Jerome	12,000	S-C-A-L	12,000
Total France		149,600		58,100

GERMANY

Prewar Germany had 34 refineries (exclusive of synthetic plants) with a crude-oil capacity of 53,150 bbl. daily. Most of these plants were destroyed or part or all of the equipment removed during the war. No official report has been issued by occupation forces as to status of refineries except the information that some of the plants are operating at capacity to supply local needs. Following are reports on some of the plants.

Ebano Asphalt-werke A.G. Never Jungfernstieg 21 Hamburg	Harburg	2,000	S-A	None
"N.I.T.A.G." Internationale Tiefbohr A.G.	Petroleumhafen	8,000	S-A	None
Rhenania-Ossag Mineralolwerke A.G. Shell-Haus. Alster-Ufer 4-5 Hamburg	Monheim	1,800	S-L-A	None
Rhenania-Ossag Mineralolwerke A.G. Shell-Haus. Alster-Ufer 4-5 Hamburg	Grasbrook	1,500	S-L	None
Rhenania-Ossag Mineralolwerke A.G. Shell-Haus. Alster-Ufer 4-5 Hamburg	Harburg	8,100	S-L-A	None
Rhenania-Ossag Mineralolwerke A.G. Shell-Haus. Alster-Ufer 4-5 Hamburg	Reisholz	1,000	S	None
Rhenania-Ossag Mineralolwerke A.G. Shell-Haus. Alster-Ufer 4-5 Hamburg	Wilhelmsburg	1,000	L-S	None
Deutsche Vacuum Oel, A.G. Semperhaus B. Spitalerstrasse 10, Bremen	Bremen	1,000	L-S	None
Total Germany		24,400		

HUNGARY

In most cases no reports are available regarding status of refineries which were privately owned previous to the war. Some are being operated by occupation forces. Following is list of plants:

Hazai Koolajipar Reszvemutarsasag, Budapest	Budapest	1,000	S-L	None
Nyirbogdanyl Petroleumgyar Reszvemtarsasag, Budapest	Nyirbogdany	300	S-L	None
Shell Koolaj Resvenytarsasag, Budapest	Budapest-Csepel	3,500	S-L-A	None
Fanto Associated Hungarian Oil Co., Ltd., Budapest 5	Budapest	1,100	S-L	None
Vacuum Oil Co. R.T., V., Budapest	Fuzito	3,800	L-W-A	None
Magyar Hydrobenzin Reszuenytarsasag, D. Nador-Utca, Budapest	Petfurdo	1,200	S-C	350
Total Hungary		10,900		350

BRITISH EAST INDIES

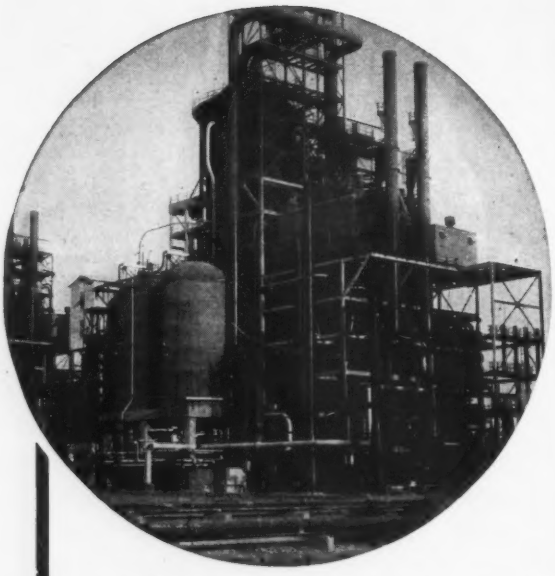
Sarawak Oilfields, Ltd., Miri, Sarawak.	Luton*	20,000	S	None

*Under repair.

NETHERLANDS EAST INDIES

All of the refineries of this area were either destroyed at the direction of the Netherlands or British governments previous to the war or were damaged during Japanese occupation. Some of the plants are now operating part capacity, their crude runs to stills totaling about 30,000 bbl. daily which is 20 per cent of prewar operations. Plans for new construction and rehabilitation are being delayed by political conditions and availability of materials.

(Continued on page 203)



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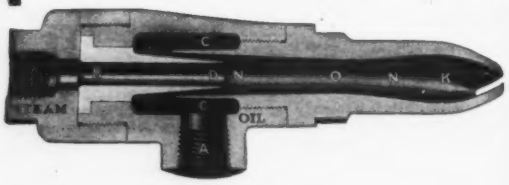

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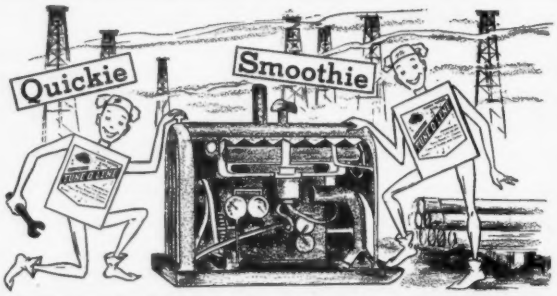

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Borneo

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
De Bataafsche Petroleum Maatschappij (Shell), Carl van Bijlandtlaan 30, The Hague	Balikpapan*	8,500	S-L	None

Java

N. V. de Bataafsche Petroleum Maatschappij (Shell), Carl van Bijlandtlaan 30, The Hague	Wonokromo	2,000	S	None
N. V. de Bataafsche Petroleum Maatschappij (Shell), Carl van Bijlandtlaan 30, The Hague	Tjepoe†	3,000	S-C	2,000
Nederlandsche Koloniale Pet. Mij. (Standard-Vacuum), Gebouw Petrolea, P. O. Box 109, The Hague	Kapoen†	500	S	None
Total Java		5,500		2,000

Sumatra

de Bataafsche Pet. Mij. (Shell), Carl van Bijlandtlaan 30, The Hague	Pangkalan Brandon†	19,000	S	None
de Bataafsche Pet. Mij. (Shell), Carl van Bijlandtlaan 30, The Hague	Pladjoe, Palembang†	40,000	S-C-L	7,700
Nederlandsche Koloniale Pet. Mij., Standard Vacuum Oil Co., 26 Broadway, N. Y. C.	Palembang†	45,000	Comp	32,000
Total Sumatra		104,000		39,700
Total Netherlands East Indies		118,000		41,700

*Under repair. †Shut down.

NETHERLANDS WEST INDIES

Aruba

Arend Petroleum Maatschappij, Willemstad, Curacao	Bruif, Aruba	20,000	S-C	3,000
Lago Oil & Transport Co., Ltd., San Nicolas, N.W.I.	Aruba	*360,000	S-C-L	200,000
Total Aruba		380,000		203,300

*Refinery has processed in excess of 400,000 bbl. daily.

Curacao

Curacaoschе Petroleum Industrie Mij., Carl van Bijlandtlaan 30, The Hague	Emmastad	200,000	S-C-L-A	100,000
Total Netherland West Indies		580,000		303,000

INDIA AND BURMA

The refineries in India and Burma were occupied by the Japanese during the war and three plants have been dropped from the prewar listings as having been totally destroyed. The plants listed below are either operating part capacity at this time or will be in the near future.

Attock Oil Co., Ltd., 24-28 Lombard St., London, England	Rawalpindi	4,000	S-C	2,500
British Burmah Petroleum Co., Ltd., Cross Keys House, 56 Moorgate, London	Rangoon	2,500	S-C	2,000
Burmah Oil Co., Ltd., 175 West George Street, Glasgow, Scotland	Rangoon	20,000	S-C	3,000
Indo-Burma Petroleum Co., Ltd., 24-28 Lombard St., London	Seikgri	3,500	S-C	1,000
Total India (British India-Burma)		30,000		8,500

IRAN

Anglo-Iranian Oil Co., Ltd., Britannic House, Finsbury Circus, London E.C. 2	Abadan	400,000	S-C-A	125,000
Kermanshah Petroleum Co., Ltd., (Anglo-Iranian), Britannic House, Finsbury Circus, London	Kermanshah	2,100	S	None
Total Iran		402,100		125,000

Note.—In addition to above Anglo-Iranian Oil Co., Ltd., operates topping plants in fields of Southwest Iran to supply local requirements.

IRAQ

Iraq Petroleum Co., Ltd., City Gate House, Finsbury Circus, London, E.C. 2	Baba Gurgur	1,500	S	None
Iraq Petroleum Co., Ltd., City Gate House, Finsbury Circus, London, E.C. 2	Kirkuk	*100,000		None
Khanaqin Oil Co., Ltd., (Anglo-Iranian), Britannic House, Finsbury Circus, London, E.C. 2	Aidwan	6,900	S	None
Total Iraq (exclusive of stabilization plant)		8,400		

*This is a crude-oil stabilization plant designed to remove H_2S.

IRELAND

Cork Harbour Oil Wharves, Ltd., 146 Dashwood House, Old Broad St., London, E.C. 2	Haulbowline	600	S	None

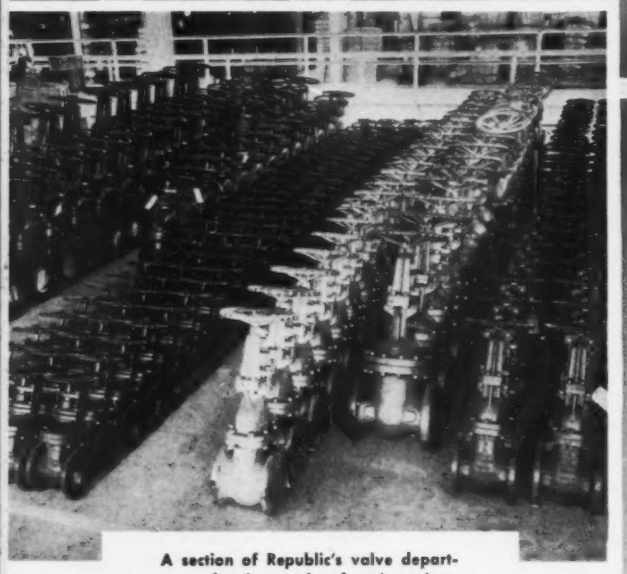
ITALY

Prewar refining facilities in Italy were largely destroyed during the war or vital equipment removed. Three plants are now operating part capacity to supply local needs. Following is a list of plants with prewar ratings whose American, British and Italian owners have announced that the refineries will be brought to prewar operating status as conditions justify.

"Aquila" S.A. Tecnico-Industriale, Trieste	Trieste	5,000	S-L	None
Azienda Generale Italiana Petroli, Rome	Venice	6,000	S-C	3,100
Distillazione Italiana Combustibili S.A., Venice	Porto Maghera	5,000	S-C	3,500
Raffineria di Olii Minerili (A.G.I.P.), Fiume	Fiume	2,500	S-L-W	None
Raffineria de Napoli S.A.I. (Socony-Vacuum), Casella Postale 269, Naples, Italy	Naples†	4,200		None
Standard Societa Italo Americana del Petrolio, 40 Via Assarotti, Genoa	Trieste†	2,500	L-A	None
Societa per Industria Italiana del Petrolio (subsidiary of "Nafta" Societa Italiana pel Petroleo ed Affini), Piazza della Vittoria, Genoa	Spezia*	6,000	S-C-A	2,000

(Continued on page 207)

MODERN REFINER



A section of Republic's valve department showing stocks of various sizes.

Plug valve stocks at Republic's new central warehouse and store in Houston.

Republic's completely stocked welding fittings department.

Partial view of flange stocks maintained at Republic's new central warehouse and store.

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* District offices and stores. † Sales Office.

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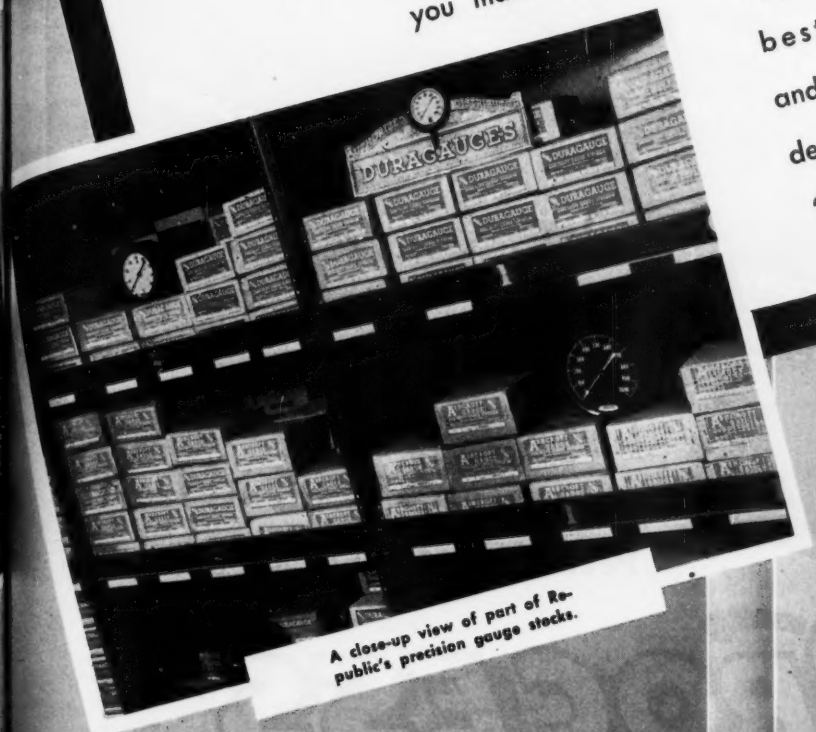

A close-up view of part of Republic's precision gauge stocks.

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ITALY (Continued)

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
Societa per Industria Italiana del Petrolio (subsidiary of "Nafta" Societa Italiana pel Petroleo ed Affini), Piazza della Vittoria, Genoa	Bari	4,400	**	2,000
Azienda Nazionale Idrogenazione Combustibili, Via Fatebenefratelli, N. 7, Milan	Leghorn	4,400	**	2,000
Total Italy		40,000		12,600

*Under repair and shut down. †Shut down. **Hydrogenation plants.

JAPAN

Previous to World War II, Japan had 29 operating refineries with a crude-oil capacity of 67,670 bbl. and a cracking capacity of 11,100 bbl. daily. These plants were owned and operated by Japanese. Some of these plants, mostly of small capacity, were destroyed during the war. The American occupation officials have announced that plants with sufficient capacity to supply local requirements will be permitted to operate. No announcement has been made as to the ownership of the operating plants.

MEXICO

Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Ciudad Madero, Tamps	57,000	Comp.	4,900
Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Arbol Granda	23,000	L-W-A	None
Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Villa Cuauhtemoc, Ver.	13,400	S-C	9,300
Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Poza Rica, Ver.	7,500	S	None
Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Minatitlan, Ver.	28,000	S-L	None
Petroleos Mexicanos, Av. Juarez 94, Mexico, D.F.	Atzcapotzalco, D.F.	50,000	S-C	13,500
Total Mexico		178,900		27,700

The new plant at Atzcapotzalco, D.F., added 26,900 bbl. daily to the crude-oil capacity and 13,500 bbl. daily to cracking capacity The new facilities also include alkylation and isomerization.

NETHERLANDS

N. V. de Bataafsche Petroleum Maatschappij (Shell), Carl van Bylandtlaan 30, The Hague	Rotterdam	14,000	S-A-C	16,500
Total Netherlands		14,000		16,500

PALESTINE

Consolidated Refineries, Ltd. (Anglo-Iranian and Shell), Britannic House, Finsbury Circus, London E.C. 2	Haifa	84,000	S-C	33,000

PERU

Establecimiento Industrial de Zorritos, Apartado 130, Calle Constitucion 25, Callao	Zorritos	1,000	S	None
International Petroleum Co., Ltd., 56 Church St., Toronto, Sarnia, Ontario, Canada	Talara	26,000	S-C-L	7,000
Compania de Petroleo Ganso Azul, Ltda.	Agua Caliente	1,000	S	None
Total Peru		28,000		7,000

PORTUGAL

Soc. Anonima Concessionaira da Refinacao de Petroleos em Portugal "Sacoy," Cado Ruivo, Casal des Roldas m.r., Apartado 539, Lisbon	Lisbon (Cado Ruivo)	6,100	S-L	None

ROMANIA

Prewar the crude-oil capacity of Romanian refineries totaled 225,000 bbl. daily. Several plants were partially destroyed during the war and others were torn down and removed. Crude-oil runs to stills now reported to be approximately 80,000 bbl. daily Following is a list of plants which are either operating or plans have been announced for rehabilitation.

Astra Romana S.A. (Shell), No. 32 Boulevard Regele Carol 1, Bucarest	Ploesti-Sud	38,000	Comp.	12,000
Colombia Societie Franco-Rumanine de Petrol, 10 rue Romania, Bucarest	Ploesti-Sud	10,000	S-C	5,000
Concordia Societie Anonyme Rumaine pour l'Industrie due Petrole, Strada Matei Millo, No. 15, Bucarest	Ploesti-Nord	29,000	S-S	4,200
Creditul Miniere S.A. Rumaine pour le Developpement, de l'Industrie Miniere, Boulevard Bratianu 16, Bucarest	Brazi-Prahova	11,000	Comp.	3,500
Dacia Romano Petroleum Synd., Ltd., 83 Cannon St., E.C. 2, London, England; Cantacuzino 33, Bucarest	Ploesti-Nord	5,000	S	None
Neo Petrole (Fratia)	Ploesti-Sud	3,000	S	None
"Petrol Block" Societe Anonima Romana, Strada Nicolae Golescu No. 7, Bucarest	Ploesti, Bucarest	8,500	S-C	4,000
Petrol Latina, S.A. Romana, Strada Benito Mussolini 53, Bucarest	Ploesti	3,000	S	None
"Photogen" Rafineria de Petrol, S.A. (Socony-Vacuum), Str. Juli Maniu 104-108, Brasov	Ploesti-Nord	3,500	S	None
Romano-Americana S.A. (Standard of New Jersey), 126 Calea Victoriei, Bucarest	Teleajen	20,000	Comp.	8,000
"Romano-Belgiana Depetrol" S.A., Strada Biserica Amzel No. 28, Bucarest	Ploesti	5,000	S	None
Spies Petroleum Co., Ltd., 17 Waterloo Place, S.W. 1, London, England	Campina	31,000	Comp.	6,300
Steaua Romana S.A. pour l'Industrie du Petrole, Boulevard Carol No. 17, Bucarest	Moinesti	2,000	S	None
Rafinaria de Petrol Titan, S.A.R., Boulevard Carol No. 30, Bucarest				
"Unirea" Societate Anonima Romanada Petrole (Phoenix Oil & Transport Co., Ltd.), Strada Gen. Berthelot No. 90, Bucarest	Ploesti (2 plants)	23,000	Comp.	3,500
Total Romania		190,000		46,500

SWEDEN

A. Johnson & Co., Stockholm	Nynashamn	3,500	S-C	2,700

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TRINIDAD

Company and address—	Plant location	Crude capacity (bbl. dly.)	Type of refinery	Cracking capacity (bbl. dly.)
Trinidad Central Oilfields, Ltd., 16 Cameron St., London, E.C. 4	Claxton Bay, Tabaquite	500	S	None
Trinidad Lake Asphalt Operating Co., Ltd. (subsidiary of General Asphalt Co.), Barber, N. J.; Philadelphia	Brighton	1,000	A	None
Trinidad Leaseholds, Ltd., Salisbury House, London Wall, London E.C. 2	Point-a-Pierre	50,000	S-C	40,000
United British Oilfields of Trinidad, Ltd., St. Helen's Court, Great St. Helen's, London, E.C. 2	Point Fortin	28,000	S-A	None
Trinidad Oil Fields Operating Co., Ltd., Port of Spain	La Brea	1,300	....	None
Goldan & Co., Ltd., Mon Repos, San Fernando	.....	500	S	None
Kern Trinidad Oilfields, Ltd., 36-38 Kingsway, London W.C. 2	San Fernando	1,000	S	None
Total Trinidad		82,300		40,000

UNITED KINGDOM (England)

A.G.W.I. Petroleum Corp., Ltd., Brettenham House, Lancaster Pl., London, E.C. 2	Fawley*	15,000	S-C-A	8,000
Berry, Wiggins & Co., Ltd., 86 Strand, London W.C. 2	Kingsnorth, Kent	2,500	S-L	None
Berry, Wiggins & Co., Ltd., 86 Strand, London W.C. 2	Weaste	1,500	S	None
Cory Brothers & Co., Ltd., 57-59 St. Mary Axe, E.C. 3, London	Coryton	4,000	S-C	2,000
Lobitos Oilfields, Ltd., 146 Dashwood House, Old Broad St., E.C. 2, London	Ellesmere Port	3,500	S	None
London and Thames Haven Oil Wharves, Ltd., 3 St. Helen's Place, E.C. 2, London	Thames Haven	10,000	S-L	None
London and Coastal Oil Wharves, Ltd., 85 Gracechurch St., E.C. 3, London	Canvey Island	1,500	S	None
Major & Co., Ltd., London	Hull	1,250	S-L	None
Manchester Oil Refinery, Ltd., Twining Road, Barton, Manchester	Trafford Park	2,800	S-L	None
Shell Refining & Marketing Co., Ltd., St. Helen's Court, Great St. Helen's, E.C. 3, London, W.I.	Shell Haven	16,500	S-L-W-A	None
Shell Refining & Marketing Co., Ltd., St. Helen's Court, Great St. Helen's, E.C. 3, London, W.I.	Stanlow	18,300	L-A	None
Total England		76,850		10,000

*This refinery controlled by Standard Oil Co. (New Jersey) is to be expanded to 69,000 bbl.

SCOTLAND

Shell Refining and Marketing Co., Ltd., St. Helen's Court, Great St. Helen's, E.C. 3, London, England	Ardrossan	4,500	S-A-L	None
Scottish Oils, Ltd. (Anglo-Iranian), 53 Bothwell St., E.C. 2, Glasgow	Grangemouth	7,500	S-C-L	3,000
William Briggs & Sons, Ltd., East Camperdown St., Dundee	Dundee	600	S-A-L	None
Total Scotland		12,600		3,000

WALES

National Oil Refineries, Ltd. (Anglo-Iranian), Britannic House, Finsbury Circus, E.C. 2, London, England	Llandarcy	7,500	Comp.	4,000
Total Wales		7,500		4,000
Total United Kingdom		96,950		17,000

U.S.S.R. and U.S.S.R. Controlled

No official information is available covering the refinery operations in the U.S.S.R. and the countries controlled by the U.S.S.R. Previous to World War II, Russia was credited with 13 refineries with a crude-oil capacity of 637,500 bbl. daily and a cracking capacity of 178,500 bbl. daily. Part of this prewar capacity was destroyed during the war and present effective capacity is estimated to be 500,000 bbl. daily including three new plants of United States design, construction on which started during the war period.

Previous to the war, Czechoslovakia had 12 refineries with a capacity of 12,300 bbl. daily; Poland, 19 plants with a capacity of 23,000 bbl. daily, and Yugoslavia, 3 plants with a capacity of 4,800 bbl. daily. Russia is reported to be carrying on refinery operations in all occupied countries. Previous to the war Estonia had two small shale-oil plants, and Latvia, one small plant.

UNITED STATES

Total United States, 411 active refineries. (See March 30, 1945 issue, The Oil and Gas Journal, for information by plants)		5,288,405		3,108,920

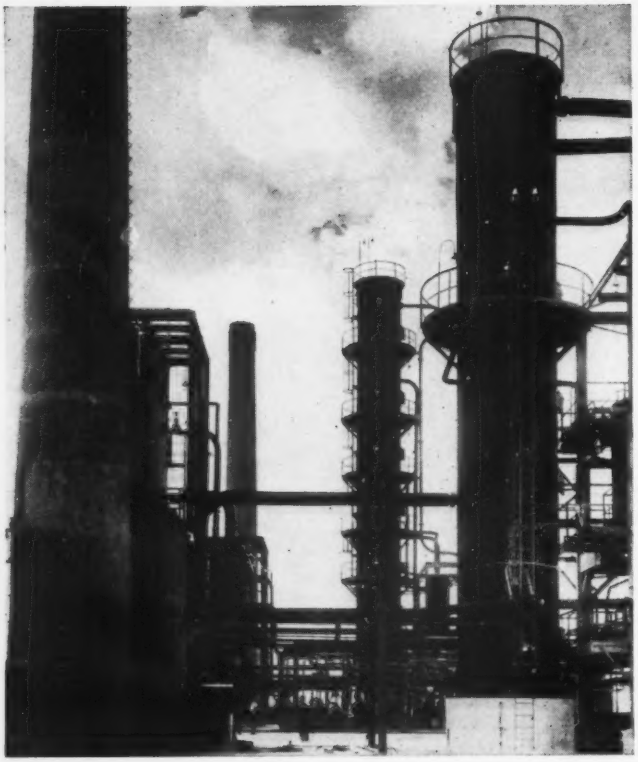
URUGUAY

Administracion Nacionale de Combustibles Alcohol y Portland (A.N.C.A.P.), 25 de Mayo 409 (P. O. Box 869), Montevideo	Montevideo	8,000	S-C	2,000

VENEZUELA

British Controlled Oilfields, Ltd., Caracas	El Mene de Mauroa	250	S	None
Caribbean Petroleum Co. (Shell), 117 Main St., Flemington, N. J. U. S. A.	San Lorenzo	38,000	S	None
Colon Development Co., Ltd., (Shell), Mijares Mercedes 25, Caracas	Casigua	700	S	None
Colon Development Co., Ltd., (Shell), Mijares Mercedes 25, Caracas	La Rivera	200	S	None
Colon Development Co., Ltd., (Shell), Mijares Mercedes 25, Caracas	El Calvario	200	S	None
Creole Petroleum Corp., Apartado 889, Caracas	La Salina	36,500	S-A	None
Creole Petroleum Corp., Apartado 889, Caracas	Caripito	52,500	S-C	52,500
Mene Grande Oil Co., Apartado 234, Maracaibo	Cabimas	1,800	S	None
Mene Grande Oil Co., Caracas	Oficina	830	S	None
Total Venezuela		130,980		52,500

Note.—Shell interests have 40,000-bbl. refinery under construction at Punta Cardon. Creole Petroleum Corp. has announced plans for the construction of a 70,000-bbl. refinery at Amuay Bay. Mene Grande Oil Co. (Gulf) and Sinclair Oil Corp. have plans to build refineries at Puerto La Cruz.



Distillation section of the Bari oil refinery

Italian Oil Industry Soon To Resume on Expanded Scale

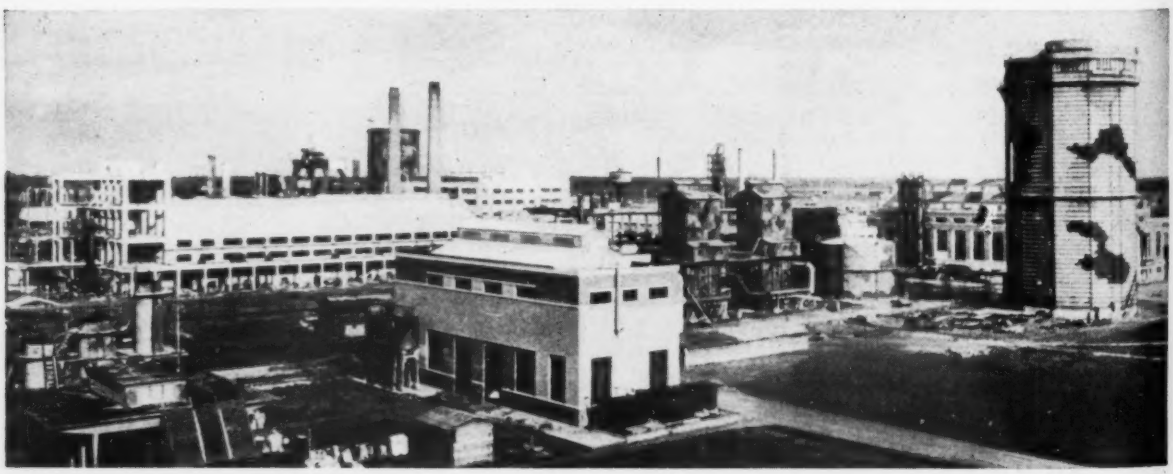
by Antonio Giordano

MILAN.—The Italian oil-refinery organization has been set in motion again since reports from Bari announce that the first crude-oil shipments have arrived there destined to the A.N.I.C. refinery which has resumed working. This refinery has at present capacity of 120,000 tons (840,000 bbl.) of benzine yearly through the hydrogenation process in addition to two thermal-cracking units and distillation equipment for the output of fuel oil. Plans have been worked out to increase the output of the refinery. Reports from Naples state that both the refinery of the Azienda Generale Italiana Petroli and the refinery of Socony-Vacuum Oil Co., Inc., are to resume operations during December and that shipments of 800,000 bbl. of crude oil from Saudi Arabia are on route to Naples to be refined there on behalf of Arabian American Oil Co., owner and operator of a large concession in Saudi Arabia. In connection with the resumption of activity of the Naples refining plants of Socony-Vacuum, it is reported that a Houdry catalytic plant, a Duo Sol distillation plant, and a Dubbs thermal-cracking unit are being installed. Should it be decided to use regularly this refinery for the distillation of Arabian oil to be distributed through European markets, the cracking facilities may be enlarged.

At the Venice (Porto Marghera) refinery of Azienda Generale Italiana Petroli (A.G.I.P.), where two Dubbs thermal-cracking plants were installed just before the outbreak of the war, the rehabilitation program has made much progress, and it is expected that the refinery is to resume its activity during January 1947, as well as La Spezia refinery of the Societa per l'Industria Italiana del Petroli (I.N.P.E.T.) belonging to the Royal Dutch-Shell group, where two Dubbs cracking units are to be placed in operation.

A.G.I.P. has in project also an enlargement of the Vado Ligure (Savona) refinery belonging to the S. A. Raffineria Italiana Olii per Trasfor-

View of Leghorn plant



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matori, while the question of the rehabilitation of the Leghorn refinery of A.N.I.C. is still under consideration. Future plans will depend upon the settlement of the whole problem of the Italian oil industry and trade on the Italian market which still awaits a solution.

In fact, though Standard Oil Co. (N.J.), Royal Dutch-Shell, and The Texas Co. have their Italian subsidiaries which had been seized by the Italian Government during the war, yet with the conclusion of the peace treaty their activity will be legally sanctioned on the Italian market and it will be made known within what limits the petroleum industry might be developed in Italy. Only the political position of Italy explains the delay in the resumption of activity of these concerns on the Italian market, where there is such a famine of oil and petroleum products that commencing January 1, 1947, motor-vehicle operation is to be greatly reduced. This is despite the reported agreement between the Italian Government and Standard and Shell under the auspices of UNRRA, and in the settlement of the question of the realization of the projects regarding the construction of new oil refineries in the Adriatic, Sicily, and in the Genoa district to meet the decreased output of the Italian refining industry in consequence of the transfer of Fiume to Yugoslavia and with reference to the internationalization of the port of Trieste.

In connection with the activity of the Italian refining industry it should be noted that regarding the prospects of developing oil output in the Lodi district (Milano), the possibility of enlarging the Fiorenzuola d'Arda (Parma) refinery is being considered, while the Societa Idrocarburi Nazionali of Florence, which is increasing output at Pietramala, is considering the possibility of enlarging its local refining organization with the addition of some cracking units. Furthermore, the possibility is again being discussed of erecting a Fischer-Tropsch plant at San Giovanni Valdarno by Societá Italiana per i Carburanti sintetici which, owing to the difficult situation of transport in Italy, has found difficulty in distributing the lignite produced in that district and would like to use it on the spot.

Of course the future of the Italian refining industry is directly connected with the supplies of crude oil, and in this connection it is interesting to note that the Italian Government has just issued a decree that oil imported into Italy on behalf of UNRRA is to be exempted from payment of import duty. Currency facilities are extended to those who want to import oil into Italy provided they are direct consumers and not merchants of such products, in which case evidence will have to be produced that the goods to be imported are destined for consumption and not for speculation.

It is not unlikely that truck operators, too, will form a corporation to import oil for operation of road transports, and that the Italian automobile industry is to sell cars abroad against oil or petroleum products. A barter arrangement appears to have been concluded for import into Italy of oil and petroleum products against merchant tonnage to be built in Italian shipbuilding yards.

The Italo-Hungarian trade agreement signed in Rome on November 9 provides, on the other hand, for Italian deliveries to Hungary of machinery, machine tools, sulfur, motor vehicles, etc., while Hungary will supply Italy with 60,000 tons (420,000 bbl.) of petroleum products, especially kerosene, gasoline, paraffin wax, and vaseline, in addition to agricultural products. The value of exports under this agreement is fixed at some two milliard lire in both directions. The agreement is significant particularly for the fact that this will be the first time Italy has received such oil imports from Central European oil fields on a commercial scale.

During 1946 Italians have made several efforts to effect negotiations with Mexican and Venezuela oil organizations, offering them machinery, textiles, automobiles, and labor in exchange for oil and petroleum prod-

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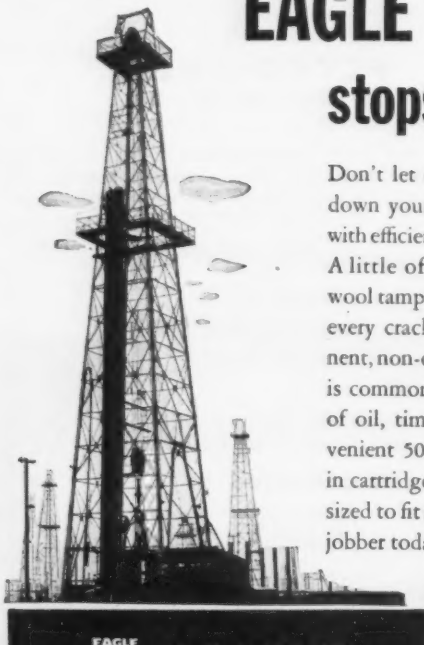

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ucts, but nothing definite has been concluded.

Saudi Arabia and Kuwait Expansion

(Continued from page 176)

the Dammam field and the wells that were drilled in that area starting in 1941 were permitted to produce. Another large line is being completed to the field as a result of additional discoveries. The latest discovery, which is considered highly important from the standpoint of the field and the entire oil area, is the No. 10 Abqaiq. It is 6,000 ft. west of the No. 5. It is the lowest well in the field by 600 ft., reaching 1,450 ft. below the crest. The water level has not been determined. The new well, which extends the field geographically and deepens the pay zone, is now producing 10,000 bbl. daily of clean oil. The proven reserve of the Abqaiq field is now believed to exceed 3 billion barrels. There are four more wells drilling in the Abqaiq field and two rigging up. One well is drilling in the Dammam field.

Midway between the Dammam field and the Ras Tanura refinery the discovery well is producing in the Qatif field. The company has plans to drill additional wells in that field. There have been no new developments in the Abu Hadriya field which was discovered in 1940. This field produced from a depth of 10,200 ft., the deepest producing horizon so far discovered in the Middle East.

Present production of Saudi Arabia is more than 200,000 bbl. daily. The new Ras Tanura refinery, which was rated a 50,000-bbl unit during construction in 1945, is now refining 95,000 bbl. daily. The enlarged output is made possible by converting the plant's operations to the maximum production of intermediate and residual products. In addition to supplying the Ras Tanura and Bahrein refineries with crude oil, the company is now making offshore shipments to Argentina and Italy. The company has announced plans to build a refinery in Egypt.

Plans to build a big-inch pipe line from the fields near the Persian Gulf to the Eastern Mediterranean are of major importance. A wholly owned subsidiary, Trans-Arabian Pipe Line Co., has been organized by the Arabian American company to build and operate the pipe line. Engineers are now making a final survey of the pipe line route. Right-of-way concessions have been granted in Palestine, Trans-Jordan, Lebanon, and Saudi Arabia. The exact site of the terminal on the Eastern Mediterranean has not been announced. Plans as to the diameter of the line vary from 24 to 30 in.

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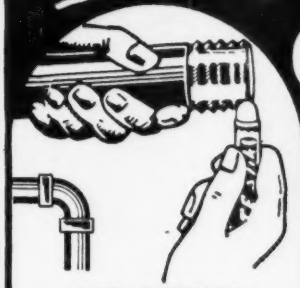

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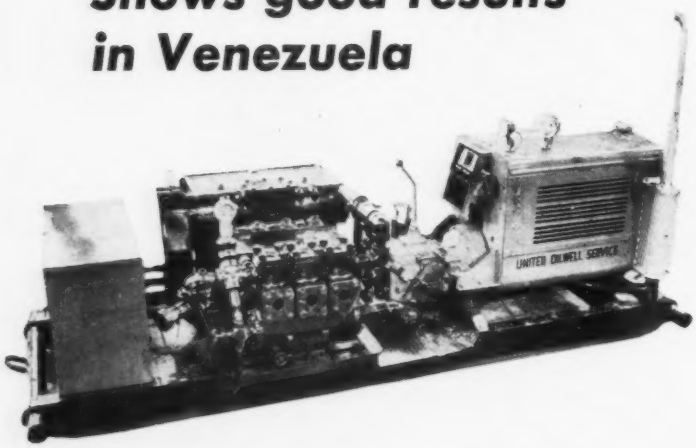


by Charles W. Fowler*

THE use of chemicals in oil and gas wells to improve their producing characteristics has been an established practice in the United States and Canada for more than a decade, but it has only been within the last year that a chemical well-treating service has been offered in Venezuela. This new Venezuelan corporation, United Oilwell Service, S.A., maintains its general office in Caracas and its present field office and treating station at Anaco, Anzoategui, in eastern Venezuela.

*President, United Oilwell Service, S. A., Caracas, Venezuela.

Some of the outstanding successful treatments that have been made recently are:

1. A well in the Santa Barbara area of Monagas was completed with an initial production of 400 bbl. per day from sands of Upper Miocene age. This well flowed about 24,000 bbl. of oil and then ceased to produce. Before treating, all attempts to place it back on production failed. The well was swabbed, washed, and squeezed with light oil but with no results. It was then swabbed dry and treated with 3,000 gal. of inhibited acid, half of which was mud acid and the remainder wash acid. After treatment, the well was swabbed into production, flowing at the rate of 520 bbl. per day. Since then the well has produced over 38,000 bbl of oil and is still flowing.

2. In the Jusepin area of Monagas attempts to complete a well in the Upper Miocene were unsuccessful. This well was treated with 4,000 gal. of 15 per cent inhibited acid, half mud acid and the remainder wash acid. Following treatment, the well was tested by swabbing at the rate of 450 bbl. per day. This well will be placed on production as a pumper.

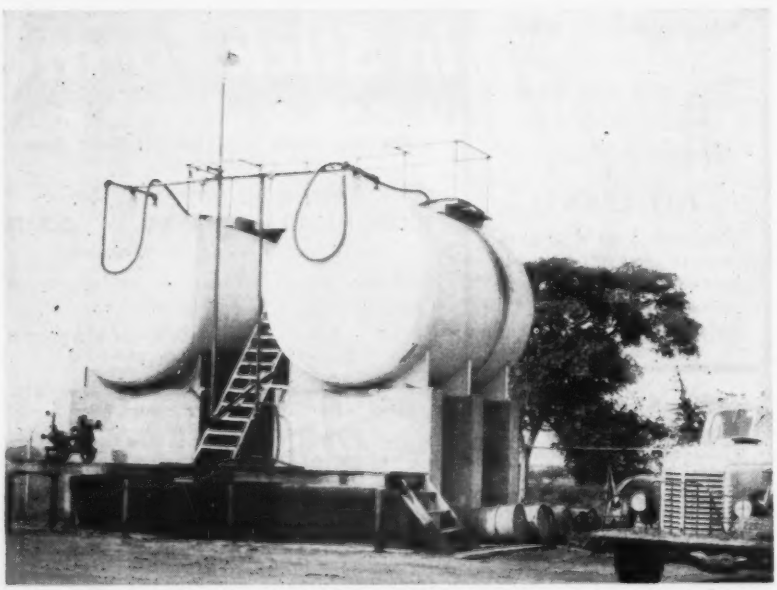
3. In the San Joaquin area of Anzoategui attempts to complete a well which showed good possibilities on a drill-stem test were unsuccessful. The well was swabbed for 36 hours with no results. It was then treated with 2,000 gal. of inhibited acid, 50 per cent mud acid and 50 per cent wash acid. After treatment, this well was swabbed into production at the rate of over 700 bbl. per day, flowing.

4. In the greater Oficina area of Anzoategui a well was completed which flowed intermittently at the rate of 10 bbl. per day. This production rate was much smaller than that shown by nearby wells and it was assumed that the abnormal production was caused by the presence of silt and other extraneous material in the critical area which was causing a reduction in permeability. Following a small treatment of 1,000 gal. of inhibited solvent, half mud acid and half wash acid, a recompletion was made with production of 225 bbl. per day flowing. This rate was comparable to the surrounding wells.

5. To date one attempt to remove stuck drill pipe has been successful. In this instance, a drilling well in the Sombrero area encountered a stuck drill-pipe fishing operation involving approximately 6,000 ft. of 4½-in. of nearly new drill pipe. After trying to remove the pipe for nearly a week, during which all the normal procedures were used, 1,000 gal. of inhibited acid were pumped down the pipe and allowed to rise in the space outside the pipe. The injection was begun at 1 p.m. and at 6 p.m. the pipe was free and shortly thereafter the entire string was removed from the well.

6. To date one treatment has been made on a well producing from limestone in the State of Zulia in western Venezuela. Prior to treatment this well was producing in excess of 4,500 bbl. per day, but following application of 6,000 gal. of solvent the well was tested at an indicated rate of 11,000 bbl. per day.

At this time one complete well-treating unit is in service; two ad-



View of chemical-storage plant which will supply new Venezuelan treating operations. The picture at the top of the page shows a specially designed high-pressure skid-mounted pump for well treating in Venezuela

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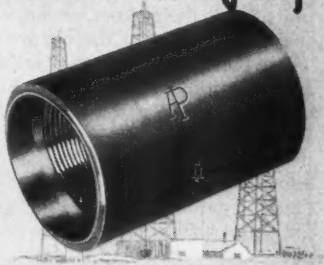

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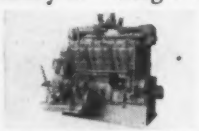

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ditional units will be available by January 1947. One of these new units is skid mounted and will be used on wildcats and other locations not easily accessible to the motorized treating units.

Other facilities at the Anaco station include a large staff house, garage, small laboratory, water and gas supply, and electric power plant. The station is located at Kilometer 98.5 on the Puerto La Cruz-Oficina highway and is within easy access to all the active fields and drilling wells in eastern Venezuela. Building construction is of hollow concrete blocks, with cement floors and corrugated asbestos roof. The garage is designed and equipped to service three pieces of equipment simultaneously.

The future program of United Oilwell Service, S.A., includes the erection of an acid-manufacturing plant at Anaco. This plant, of a new type, is being designed and constructed by Dow Chemical Co. for erection in Venezuela. It will have a capacity of approximately 4,000 gal. of 15 per cent hydrochloric acid per day. The raw materials required by this plant are principally chlorine and natural gas. Present plans call for erection and operation by the middle of 1947.

Other contemplated expansion plans include additional housing, a larger power supply, another water well, new laboratory, chemical warehouse, additional solvent storage, and motor transport. Additional services including electric pilot, water locator, permeability surveying, selective acidizing, plastic services, and industrial chemical service will be made available as soon as equipment and trained personnel can be secured.

New Field Promised by Venezuelan Producer

NEW YORK.—Pantepec Oil Co. of Venezuela, C.A., announced last week that Tucupido No. 1, being drilled by Atlantic Refining Co. under a contract with Pantepec, promises an entirely new oil field in Venezuela.

The well produced at the rate of 257 bbl. of oil per day on an 8½-hour test through a ¼-in. choke, and at the rate of 432 bbl. on a 5½-hour test through a ⅜-in. choke, the Pantepec announcement said. The oil, of 40.8° gravity, showed no water.

Tucupido is about 75 miles west of Roble field belonging to Pantepec and Creole Petroleum Corp., and approximately 35 miles northeast of Mercedes field owned by The Texas Co. and Caracas Petroleum Co. The tract on which the well is located comprises 35,000 acres.

The new well is in an area distinct and distant from the Pelayo concession, jointly owned by Pantepec and Atlantic Refining, on which Pelayo No. 1 was recently brought in, Pantepec said.

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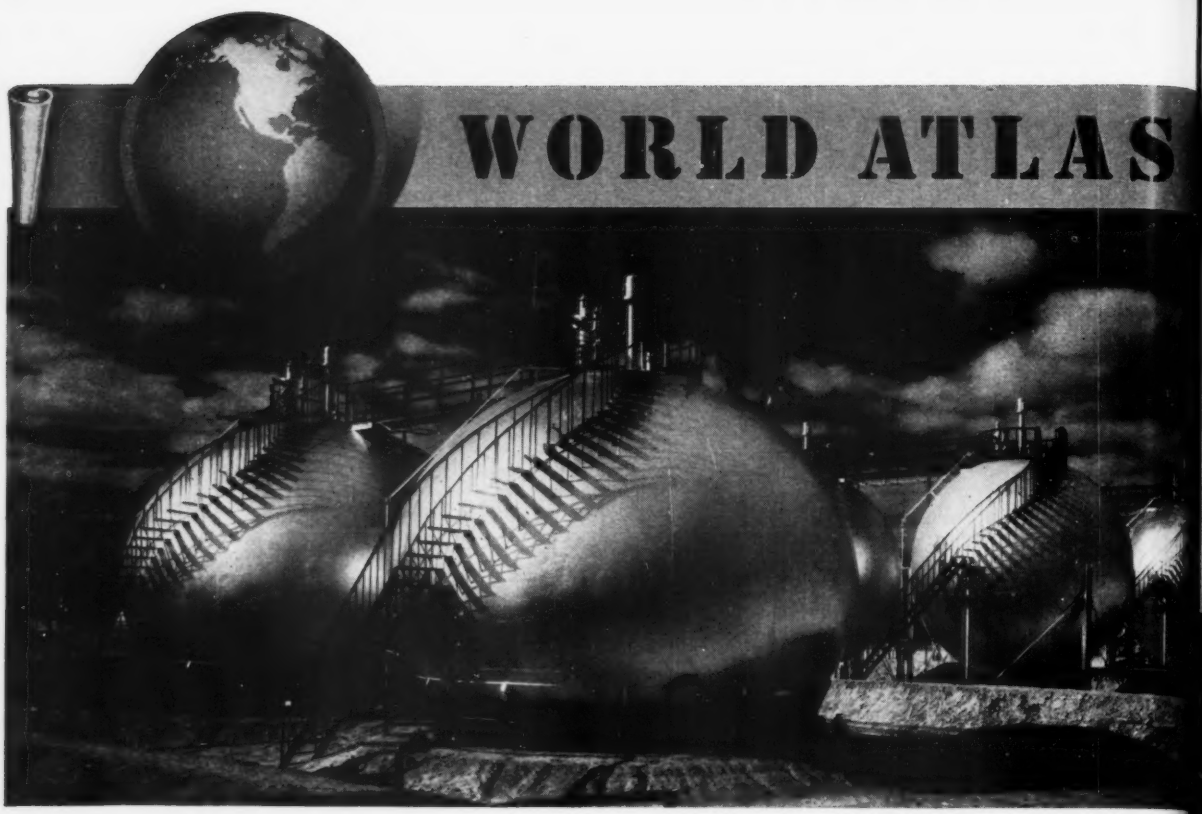
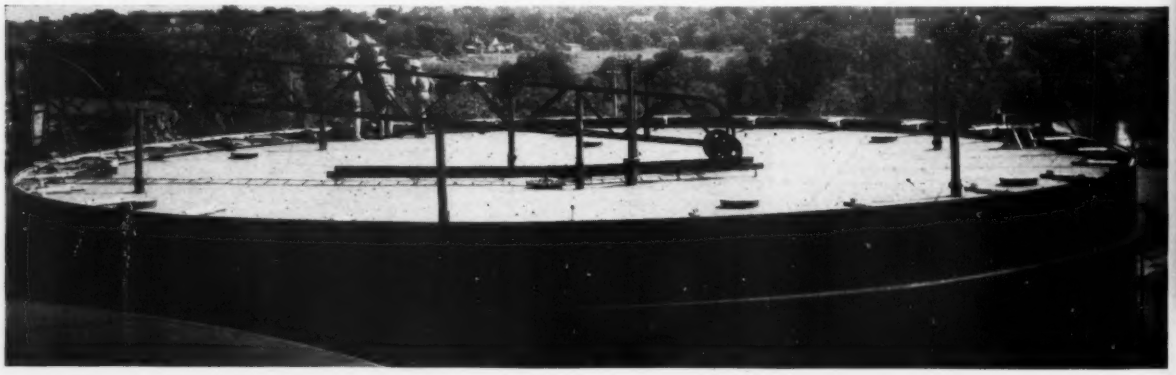


HORTONSPHERES AND HORTONSPHEROIDS . . . are two of the petroleum industry's most effective tanks for preventing evaporation during the handling and storing of hydrocarbons. The two tanks at the left in the above photo are 2,500-bbl. Hortonspheroids which operate at 15 lbs. per sq. in. pressure. Hortonspheroids, available in capacities up to 120,000 bbls., are used to store hydrocarbons ranging in volatility from motor gasoline to natural gasoline. The tanks in the background are 1,500-bbl. Hortonspheres designed for 75 lbs. per sq. in. pressure. Hortonspheres are used to store products that require pressures from 30 to 150 lbs. per sq. in. such as butane, butane-propane mixtures, the more volatile grades of natural gasoline and volatile refinery charging stock. Write for Bulletin F describing the Hortonsphere and Bulletin E describing the Hortonspheroid.



HORTON DOUBLE-DECK FLOATING ROOFS . . . are used on flat-bottom tanks to prevent evaporation losses and reduce fire hazard. They are recommended for tanks storing volatile products that do not boil at normal atmospheric temperature. Horton Double-Deck Floating Roofs are used on tanks 15 ft. in diam. or larger and are particularly recommended for tanks filled and emptied more than six times a year, tanks used in blending service and those storing sour crudes or other products which cause ordinary cone roofs to corrode rapidly. Write for new Bulletin B giving full details on the Horton Double-Deck Floating Roof.

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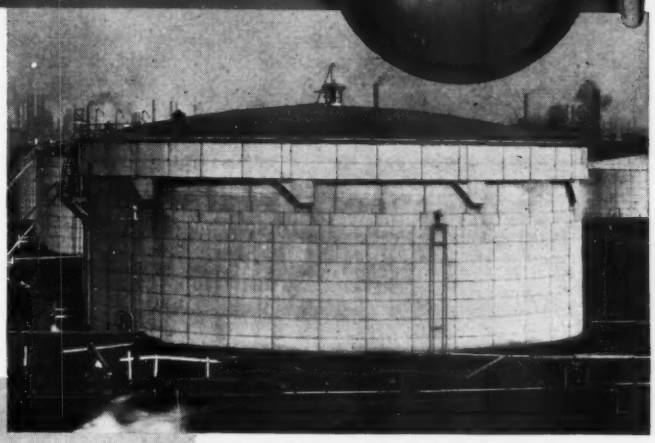

Above: **HORTON LIFTER ROOFS** — *reduce evaporation from standing storage or slow working tanks. The vapor spaces of several cone roof tanks may be connected to the vapor space of a tank with a lifter roof. When this is done the lifter roof serves all of the tanks. The* **VAPORSPHERE** *is also used as the central unit of vapor saving systems serving several tanks.*

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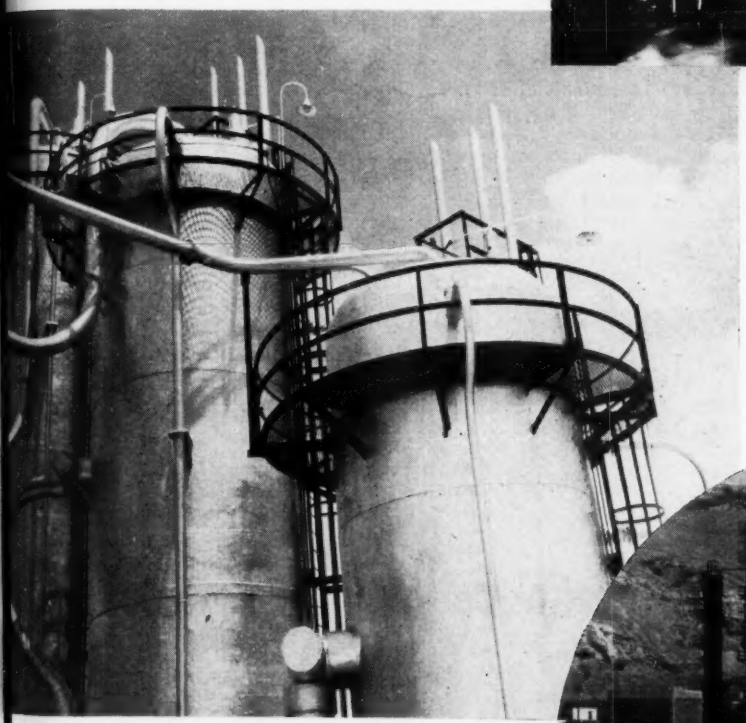

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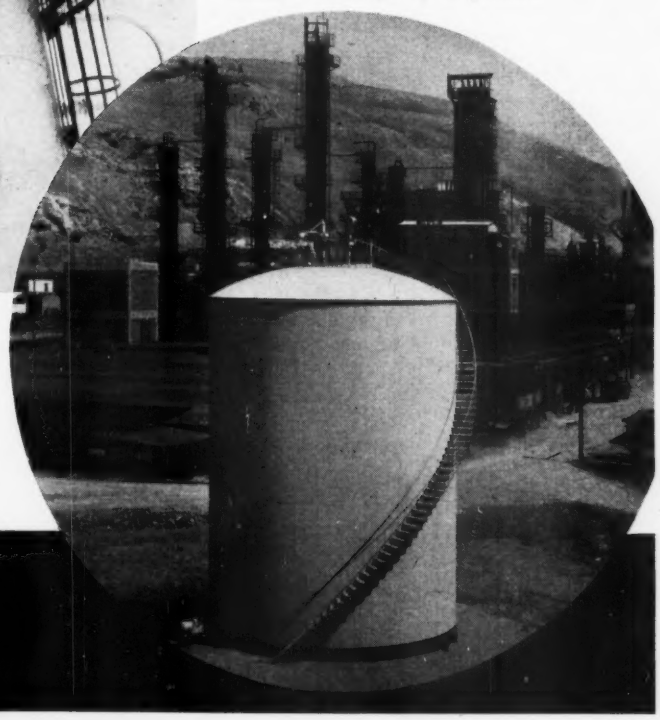

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Series Cementing in Venezuela's QUIRIQUIRE FIELD

by Paul Reed

WITH declining reservoir pressure in the Quiriquire field, Venezuela, much attention has been given by the staff of Creole Petroleum Corp. to the elimination of factors which might contribute to retarding oil movement from producing sands to the well bore. Such retardation has been referred to as the "check valve" condition resulting from several causes, including: The Jamin effect of water entering the sand during completion and workover; excessive penetration of the sand by drilling mud; and by undesirably large distribution of cement due to high differential pressures during conventional cementing operations.

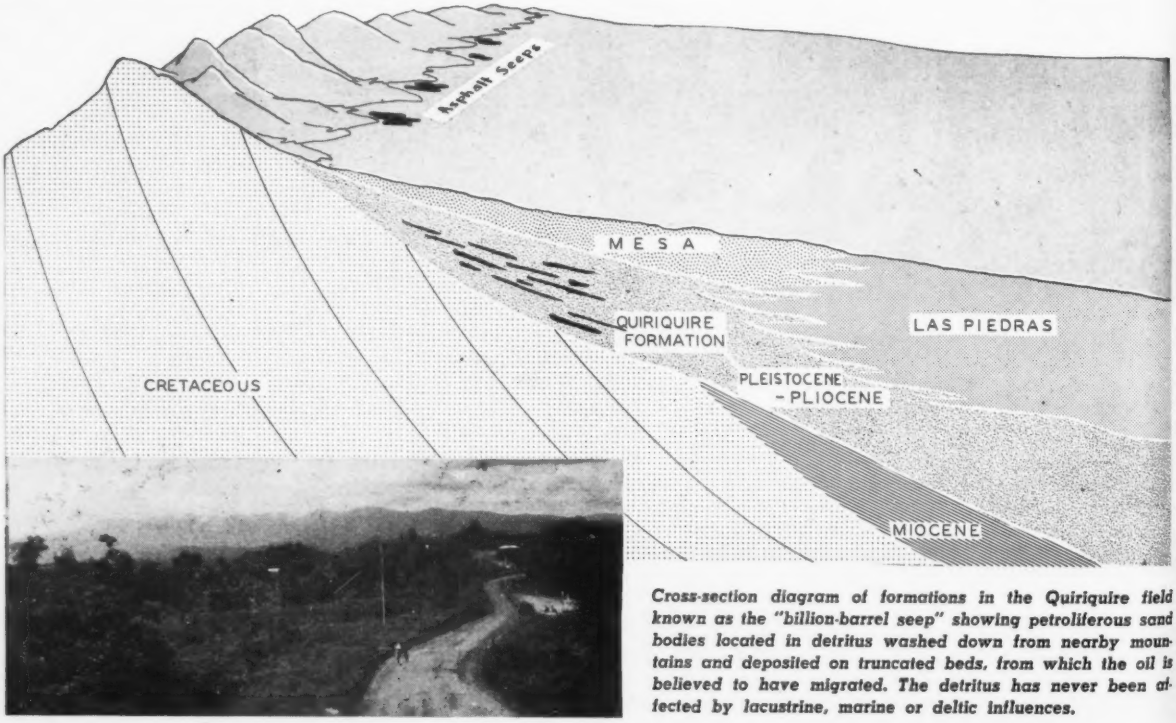
An outcome of studying these conditions has been an extensive use of series cementing which has often been used for as many as seven stages. Close supervision of the technique of such operations has made it possible to get exceptionally good results in the last 2 years with series cementing shutoffs.

Material for this article was obtained through arrangements made by Arthur T. Proudfit, president, Creole Petroleum Corp., for the author to visit Quiriquire early this year. He was assisted by Dr. Siro Vasquez, chief engineer; Thomas H. Hood, superintendent; W. Y. Brown, petroleum engineer; and R. J. Loeffler, geologist.

The significance of what is accomplished with series cementing at Quiriquire can best be indicated by outlining the basic conditions in this singular field, sometimes referred to as the "billion-barrel seep" because of the peculiar situation of the producing-sand bodies which has given it the reputation of being the most interesting field in Venezuela.

The Quiriquire field (the first large field in eastern Venezuela) made important early contributions to the expansion of the organization now operating as Creole Petroleum Corp., which owns the entire producing area.

Altogether a cumulative total of 254,000,000 bbl. has been produced since regular production began in 1931. The first well, 1 Moneb, now designated as 1 Quiriquire, was drilled in 1925; it still flows 50 bbl. of oil daily with 30 per cent water. At no time have there been more than eight rotary drilling rigs in the field to maintain production which



Cross-section diagram of formations in the Quiriquire field known as the "billion-barrel seep" showing petroliferous sand bodies located in detritus washed down from nearby mountains and deposited on truncated beds, from which the oil is believed to have migrated. The detritus has never been affected by lacustrine, marine or deltic influences.

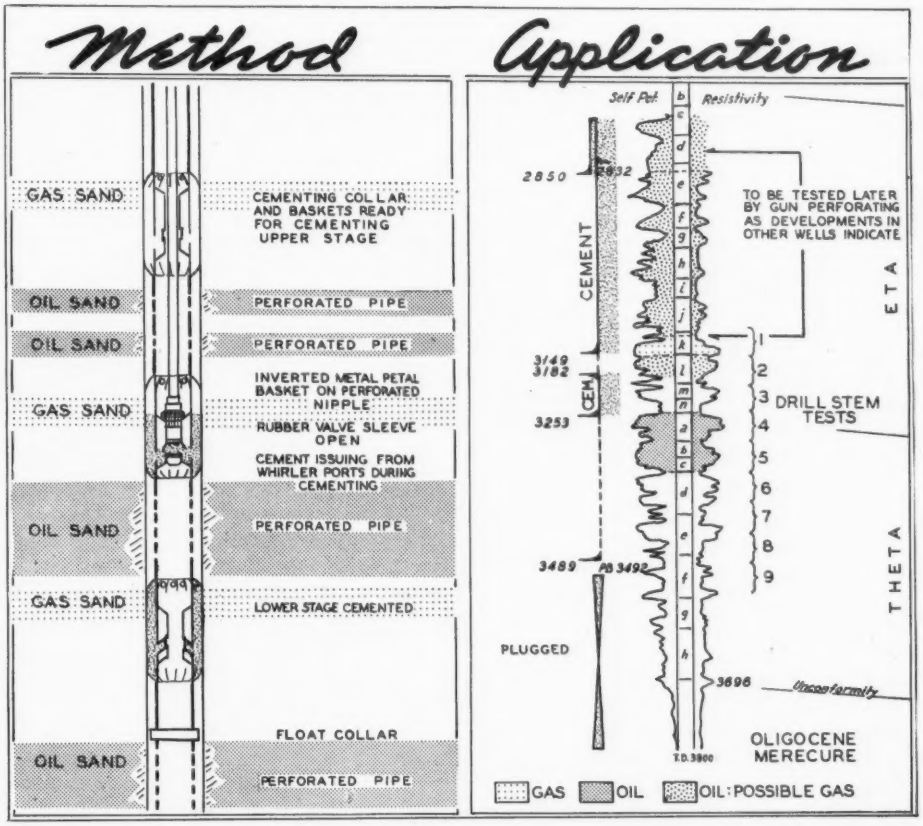
Twin wells with rolling derrick in the Quiriquire field. To the left are a pipe-line pump station, separators, and tank battery

rose to a maximum of 80,000 bbl. in 1938 and is now maintained steadily at 50,000 bbl. daily.

In Quiriquire 100 wells have made more than 1,000,000 bbl. each. At twin wells, one, No. 124, made 2,000,000 bbl.; and the other No. 143, made 5,000,000 bbl.; the two together a total of 7,000,000 bbl. in 15 years. Some of the wells brought in currently make 300 to 800 bbl. So far oil has been taken from only a part of the possible producing area, which has 254 wells producing between 1,800 and 4,000 ft. There still remain 200 proven locations to be drilled. Because of the possibilities of the field itself as well as of wildcatting in the vicinity, more attention is now being given to exploiting the Quiriquire area.

The peculiar character of the Quiriquire field is largely due to the fact that producing sands there are in Pliocene and Pleistocene detritus which has never been affected by lake, marine, or deltic influences. Today an observer standing on the ground at the surface of such detritus at the Quiriquire field can readily see the mountains 5 km. away from which this same detritus was washed down by torrential rains. Detritus deposited as a gravel series contains the petroliferous body in the Quiriquire field. This body overlaps an unconformity comprising the truncated ends of older formations ranging from Cretaceous to Miocene. There is evidence that oil has been migrating up from the older beds and it is quite possible that the source of the oil is Oligocene.

Along the northern border of the field there are seeps which range



Method of series cementing applied in Quiriquire is illustrated in diagram (left) showing the three bottom stages of a well. Here the objective was to cement off (behind the casing) three gas sands, but not to have the cement opposite the extremely "cavy" oil sands. The gas sand for the lower stage has been completely cemented; gas sand for the middle stage is in the process of being cemented, and upper stage for the highest gas sand shown has cementing equipment in place preparatory to cementing. At Quiriquire series cementing has been done for as many as seven stages. Application of series cementing is shown by diagram (right) of Eta and Theta zones of a Quiriquire well which was surveyed both by electric and radio activity logging. Sand bodies within each zone are designated by small letters

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State, County and Other Public Bonds	29,230,367.17	Dividend Declared, Payable October 1, 1946 and January 2, 1947		168,000.00
Other Bonds and Securities	348,305.30	Accrued Interest, Expenses and Reserves		687,873.80
Loans, Discounts and Acceptances	67,567,604.10	Capital	$2,800,000.00	
Customers' Liability Account of Acceptances and Letters of Credit	684,864.96	Surplus	9,200,000.00	
Stock of Federal Reserve Bank	360,000.00	Undivided Profits	2,716,428.22	14,716,428.22
Accrued Income Receivable and Prepaid Expenses	749,672.95			
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Branch Banking Houses	571,697.80			
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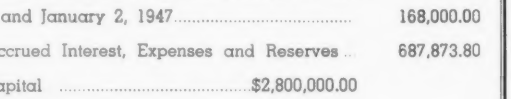

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For servicing twin wells, the derrick mounted on rollers can be slid on tracks made of pipe to either of the two wells

from semiactive to dead. Heavy asphaltic oil serves to plug the top of this reservoir which has been called a billion-dollar seep because of calculations of the total of Quiriquire oil which would include the amount which escaped in earlier ages, plus the amount remaining in the ground, and plus 254,000,000 bbl. already produced. Quiriquire is significantly located at the north end of the great Amacuro geosyncline which extends to the Brazilian shield.

To find the source beds of the Quiriquire field, it is expected that extensive wildcatting will be necessary. The current drilling program has provided for outpost wells to find possible Miocene oil formations.

Contrasted with the Jusepin-Mulata field there are no markers for correlation of the Quiriquire producing formations because they are coalescing alluvial fans. Reserve calculations are difficult because of the impossibility of recovering cores in an undisturbed state. Sand is too loose for permeability tests; it is mixed with boulders and pebbles. Electric logging only indicates the existence of a sand body. Neutron and gamma-ray logging has been useful in areas which were drilled prior to Schlumberger logging.

Approximately 40 per cent of proven reserves have been recovered to date. Recovery has been estimated as 250 bbl. per acre foot in the developed sections (12 by 4 km. oval shaped) amounting to 2,700 acres of a possible producing area of 12,000 acres. The last pressure survey indicated a drop of 1.43 lb. per million barrels withdrawn.

The producing sand bodies contain boulders as large as 2½ ft. in diameter together with cobbles and masses of clay. Of the 1,400 ft. of producing section, 700 ft. is net sand in the central portion of the field. Producing formations are regarded as lenticular beds. A known fault through the field divides it into two areas. However, in its effect on the accumulation of oil the fault is secondary to the trapping of oil by the asphalt plugs previously mentioned. Altogether the field has three segments. Of importance for oil producing is the west segment making 14°-16° A.P.I. gravity oil and the east one making 15°-34° A.P.I. gravity oil.

Quiriquire crude oils have several peculiarities. When high and low-gravity oils from the field are mixed the heavier oil will settle and separate from the lighter. Highest gravity oil ever found in the field is from well No. 248, of 38.2° A.P.I., which was obtained in a drill-stem test. The highest gravity oil currently being produced is 34°-35° A.P.I. In rare cases gravity changes in a single well may vary from 24° A.P.I. to 16.5° A.P.I., in the same month. As an example, a well in such a period produced 500 bbl. of 24° and 521 bbl. of 16.5° A.P.I. gravity oil. Another peculiarity is that once or twice a month a well that has been making 250 bbl. daily may suddenly increase to 1,000 bbl. daily.

Electric pumping has been very satisfactory. Of the 230 pumping wells, 228 are electric driven and 2 are pumped by gas engines. Power is transmitted by highline from the refinery at Caripito. Pumping wells average 187 bbl. daily; there are also 27 flowing wells averaging 345 bbl.

To maintain the life of the field a continuous workover program is necessary for repairing wells so that proper isolation of sands is accomplished. Workover costs as much as new drilling. But if it is not done when needed, wells may be ruined.

The last pressure survey indicated that there had been a drop of 1.43 lb. per million barrels withdrawn. From the 1,160 lb. original reservoir pressure the field has declined to an average weighted pressure in recent months of 757 lb. This drop of 400 lb. means that there is enough reservoir pressure to satisfactorily produce the oil if there are no obstructions.

In certain wells there is not enough pressure to bring the oil from the formation where there is water block. Jamin action will result where water gets in the formation during completion or workover.

Steps which have been considered to remove the check valve effect are the following in the order of their importance: (1) Series cementing; (2) mud acid; (3) explosives; (4) special drilling muds, such as oil base, oil emulsion or starch muds; and (5) plastics for making isolations.

Electric powered pumping jacks and compressor plant for pressure maintenance

For the successful production of either newly completed or worked over wells in the Quiriquire field, it has been found that series cementing is very advantageous. Now that its merits have been demonstrated, series cementing is regarded almost as a vital necessity. This is because series cementing makes it possible to avoid impairing the oil sands as they would be impaired by ordinary plug cementing.

Obstruction of flow of oil from sands to the well bore resulting from mud penetration, Jamin effect, and cement has a serious effect. Furthermore, by ordinary cementing, large cavities now existing in sand bodies are filled with cement for such thickness that it is not possible to gun perforate or shoot with nitroglycerin effectively.

The low reservoir pressures of approximately 757 lb. weighted average at the last survey are theoretically sufficient for moving oil from the sands to the well bore but they apparently are not able to overcome the detrimental "check valve" effects produced by cementing on the face of the producing zone.

Series cementing not only provides for normally avoiding the injury of clearly defined oil sands, but it also reduces the danger of damaging them. This is because it makes it possible to conduct cementing operations at lower pressures which may be accomplished in a much shorter time.

Series cementing of four and five stages in a well has been fairly common at Quiriquire; in some wells there have been as many as seven stages. Furthermore, the record for successful shutoffs has been high.

The basic practices of series cementing have been modified by the Creole staff at Quiriquire to achieve faster streamlined procedure.

During the recent cementing of the fourth stage of a five-stage job it was observed that it is current practice to omit circulating through the mandrel between each stage. However, operators circulate when circulation pressure is excessive. At each fourth stage cement is usually circulated out.

Excess cement pumped into the well comes back into the casing through perforations in the upper nipple attached to which is an inverted metal-petal basket at the top side of each cement job.

Quiriquire series-cement jobs are executed with a high degree of precision. In addition to an experienced drilling supervisor there is always a petroleum engineer on hand who is concerned with precise measurements: one on the cement truck (Halliburton) and the other on the derrick floor.

The Quiriquire practice is to cement the intervals between the oil sands. Taking the procedure step by step from the bottom, the current procedure is as follows: A 5½-in. casing string is run in the well equipped so that just above each oil sand is a metal-petal basket installed immediately below the series, whirler, cementing collar. At a point just below the next oil sand above, there is a nipple perforated with ½-in. holes; on this nipple is installed an inverted metal-petal basket to check the upward movement of cement.

Baker series cementing equipment, manufactured by Baker Oil Tools, Inc., is used for all the Quiriquire series jobs.

The cementing operations are conducted in the following way: A series mandrel is run in the hole until it touches the shoe. Then it is pulled up from the shoe. The tripping ball is dropped to trip the tool, shearing screws in the tripping valve, which then moves down to expose the whirler cementing ports; passage of the tool on the way down releases the metal-petal baskets permitting them to expand against the side walls to form a bridge; if the hole is irregular in shape the metal-petal basket packs off to fill the annular space.

After the cementing mandrel has been tripped, it is pulled up through the series cementing collar installed for the first stage; then it is set back to test the mandrel in the blank portion. The cementing mandrel is then set down opposite the ports in the series cementing collar and cement is

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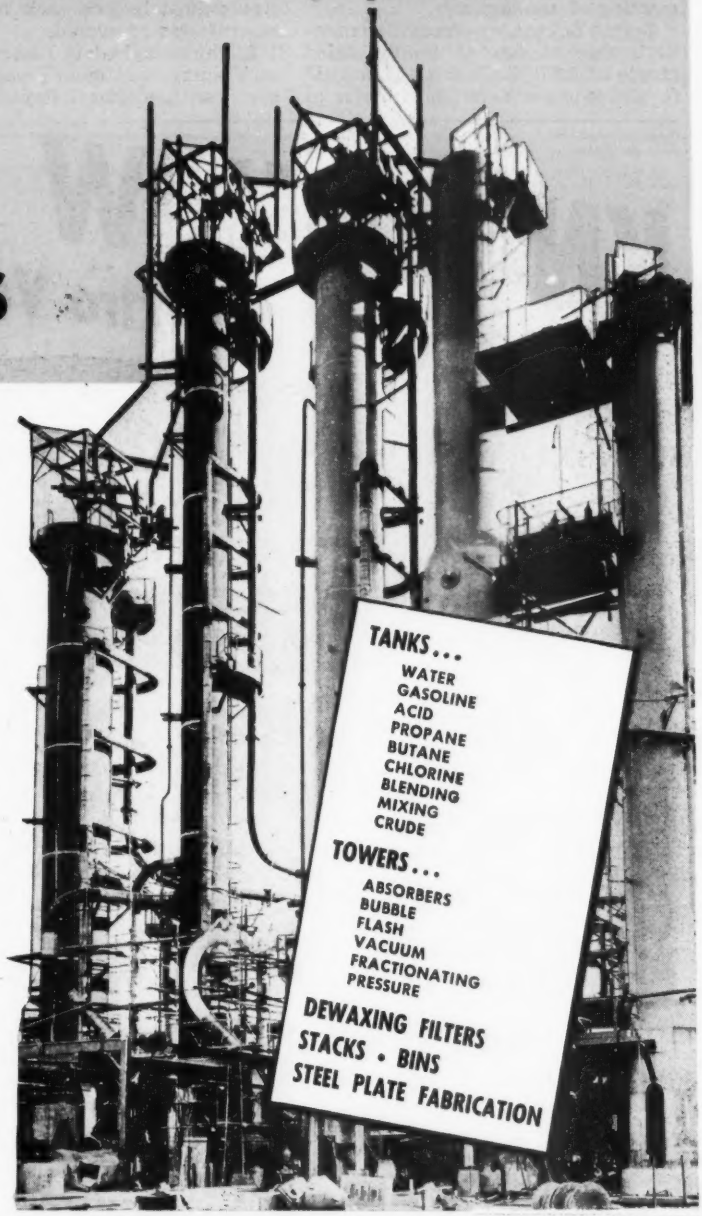

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applied. After cementing the first stage, the mandrel is pulled up through the next collar and cementing is done without testing and it is not a practice to circulate through the mandrel between each stage. Other stages are handled successively.

For the series cementing of a previous well, Q-294, details recorded have been summarized as follows:

Total length of the string of 5½-in. casing was run in the well 3,833 ft. with Baker equipment for series cementing of six stages.

1. Ran Baker series cementing mandrel, checked top of cement filled nipple at 3,651 ft. Pulled up to 3,643 ft. and circulated for 35 minutes at 650 psi. After dropping ball and shearing assembly with 1,200 psi., the mandrel was dropped into the first series cementing collar at 3,648 ft. and blank portion was tested with 800 psi. The mandrel was dropped to the circulation ports and circulation was done at 625 psi. A 20-sack (15.5 lb. per gallon) slurry was pumped with a maximum pumping pressure of 200 psi. in the 67-ft. interval between 3,584 and 3,651 ft. Mandrel was pulled to 3,564 ft. for reversed circulation. Approximately one sack of cement returns was recovered.

2. Thirty-eight-foot interval, 20-sack slurry, maximum pumping pressure less than 100 psi. Reversed circulation and recovered approximately five sacks of cement returns.

3. Seventy-foot interval, 20-sack slurry, maximum pumping pressure 200 psi. Recovered two sacks of cement returns.

4. One hundred and thirty-foot interval fill-up job. Pumped into formation at 650 psi. Got returns in cellar outside 5½-in. casing. Circulated mud for 2 hours at 450 psi. Mixed and pumped 35 sacks. Maximum pumping pressure less than 100 psi.

5. One hundred and one-foot interval fill-up job. Could not get test in blank portion and got returns in cellar outside 5½-in. casing. Circulated outside casing with 450 psi. Mixed and pumped 30 sacks, 14.0 lb. per gallon slurry. Maximum pumping pressure 200 psi. Circulation was not reversed.

6. Could not test in blank portion, got returns in cellar; circulated outside of casing with 400 psi. Mixed 200 sacks, 15.5 lb. slurry for a fill-up job. Maximum pumping pressure less than 100 lb.

In series cementing circulation is maintained all the time as it is done in a plug-type job. Cement goes up the pipe or reenters following the path of least resistance inside the pipe. A 5½-in. casing scraper cleans before running tubing.

Cementing is done at low pressures of approximately 500 lb. If pressure is raised to 700 lb. cement may penetrate the sand in a damaging manner. The advantage of series cementing is that the operator needs to wait for only one period for the cement to set. In cases where it is necessary to resqueeze the ports, the saving in time resulting from series cementing is very advantageous.

After the tool has been at the bottom, five-stage cementing may be done in a 5-hour period between the depths of 2,500 to 4,000 ft. In doing this, one stage an hour is cemented.

Series cementing has been adopted as a general practice at Quiriquire on both new wells drilled and on work-over jobs wherever it has been possible. This has been done to protect both the sands to be immediately exploited and sands to be opened during the later life of the well. Before 1939 all wells were completed with a liner in an open section of 300 to 400 ft. All new wells are cemented with three-stage cementing to insure protection of the three best zones. To do this it is necessary to have accurate measurements to determine the position of the formations.

Series cementing not only enables the operator to exclude cement from the face of oil sands, but it also makes it possible to conduct cementing operations with lower differential pressures which are especially desirable where it is either impracticable or impossible to exclude cement from the face of a sand.

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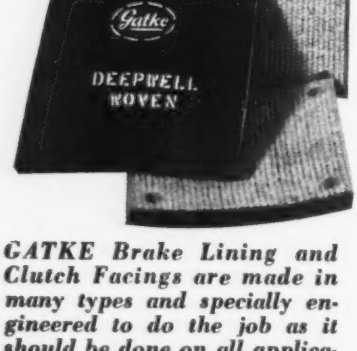

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Tank ships

(Continued from page 163)

ment regulation at 43 and 40 cents respectively, for dirty and clean cargoes, and are now set at $2.85 per ton or an average of 35.23 cents per barrel.

While rates have increased sharply within short periods of time, they have also been subject to sudden extreme reductions. It is noted that decreases of approximately 50 per cent occurred from the 1929 and 1937 highs within 2 years of the former and 1 year of the latter peak. Under competitive economic conditions a low rate level existed during the five depression years of 1931-1935 while government rate setting since the beginning of the war has resulted in a current rate of 13.62 cents per barrel below the 1941 high. Only during the depression and war periods have rates been substantially stable, at a low level during the former and a protracted high plane recently.

A prophecy of rate levels after Government ceases to stipulate what can be charged for this service will depend mainly on the availability of tank ships at attractive purchase prices, costs of operation, and finally, the demand for bulk petroleum transportation.

There can be no doubt that a sufficient supply of tankers to meet private needs is present in the large number of vessels under government ownership. It must be emphasized that the adequacy of this fleet for potential military requirements is not a consideration of this discussion.

In the matter of major operating costs, it can be stated that crew wages, repair items, food, and fuel prices have all increased more sharply and to higher levels than charter rates since the start of the war. While a slight downward revision of these cost items may be expected within the next year it must be evident that prewar operating levels cannot be reached in the near future. It can be concluded that costs will remain substantially higher for some years ahead than those prevailing in 1940.

In considering the potential demand for bulk petroleum transportation between the Gulf and North Atlantic ports, estimates of needs on the East Coast must be tempered by the final disposition of use for the big-inch pipe lines. These lines when used for oil shipments would replace approximately 60 to 66 T-2 type tank ships in this service or slightly less than 30 per cent of the present privately owned fleet. Future petroleum needs on the East Coast would, therefore, have to increase about 30 per cent to keep both the big-inch lines and the present tanker fleet occupied in transporting oil and products. While all the estimates of oil requirements for the East Coast area show considerable increases, none develop a growth of this magnitude in the near future.

In summary, it must be concluded that:

1. The United States fleet of tank ships is larger at present than the total world fleet was in 1939 thus assuring an over supply of vessels for private operation for many years.
2. Operating costs in the foreseeable future will remain at higher than prewar levels.
3. Privately owned fleets under the United States flag can meet current domestic transportation requirements. They will be sufficient to meet future needs without any increase only if the big-inch lines are utilized for shipping liquid products from the Gulf Coast. Use of these lines for natural-gas transmission would result in a gradual increase in the privately owned fleets to meet greater expected demands on the Atlantic seaboard.

Colon Production

CARACAS. — Venezuelan production of Colon Development Co., Ltd., (Shell) for the 5-week period ended December 2 was 461,911 bbl. (13,197 bbl. daily). This compares with 386,495 bbl. (13,803 bbl. daily) for the 4-week period ended October 28 and 405,994 bbl. (14,449 bbl. daily) for the 4 weeks ended September 30.

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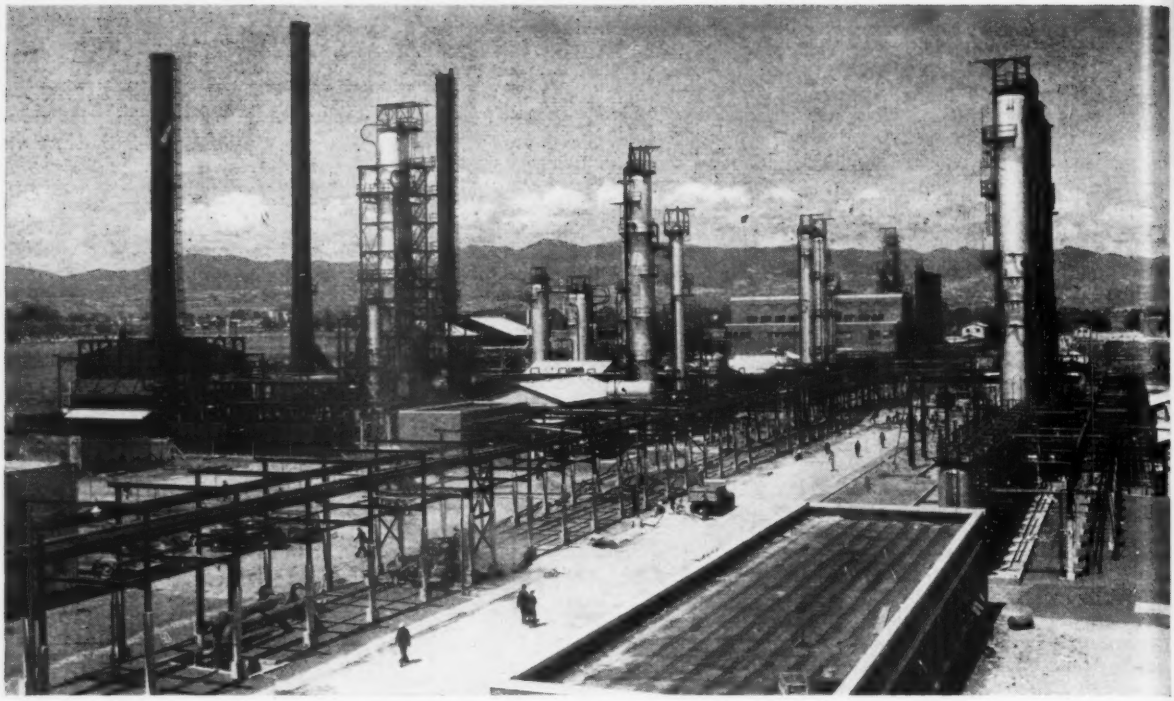

General view of the new Eighteenth of March refinery at Atzcapotzalco near Mexico City

Organization and Operation of Refining Division of Petroleos Mexicanos

by Ing. Carlos Corcuera

DURING the Diaz regime in Mexico, in the early years of the twentieth century, a few companies were granted concessions covering most of the crude-oil production in Mexico. These companies included Standard Oil Co. and S. Pearson & Son, whose holdings were along or near the Gulf Coast. The ports of Tampico and Minatitlan became the refining centers for these various companies. Panuco crudes yielded good asphalts, while crudes from the Isthmus gave industrial lubricants. Markets for both of these classes of products were found, chiefly abroad.

In 1931, to meet increasing market demands, a pipe line was built from Poza Rica field to Mexico City, and a refinery started at Atzcapotzalco, of 7,000 bbl. per day capacity. By this time the Aguila refinery at Tampico had reduced crude runs from 65,000 bbl. in 1922 to 53,000 bbl. in 1930, due to falling production from the Golden Lane fields. When Poza Rica was proved as a large field Aguila Co. (Shell), Sinclair-Pierce Co., and Standard Oil Co. (N. J.) began refinery expansion programs. By 1937, in fact, domestic Mexican consumption was 40 per cent of the total home production. Foreign markets and tanker services were lost by these companies' establishments when the oil properties were expropriated.

After expropriation, the government set to work to establish an operating section or organization somewhat similar to that which before had managed the Aguila properties which included three refineries at the three cities mentioned previously. The new organization had the business of managing the entire Mexican oil industry. Production and refining activities were placed under separate agencies—the production division and the refining division.

The refining division controls all operations, maintenance, and development; handles crude oil received at plants, and covers in general all refining-administrative and technical functions. This organization operates through a head office in Mexico City, and three zones: northern, central and southern. The northern zone includes the Ciudad Madero, Arbol Grande, Mata Redonda, and Bella Vista refineries and the Poza Rica primary distillation unit. The central zone manages the Atzcapotzalco refinery and plant C-1 which produces tetraethyl lead. Southern zone activities include only the Minatitlan refinery.

Work of the refining division is directed by a manager and an assistant manager, responsible to general management for the proper functioning of the refining industry. A department for manufacturing and shipping programs formulates the manufacturing program and is responsible for correlation among crude supply, stocks of crude and products, market demands, etc. A chemical department supervises refinery laboratories and is responsible for product quality and its control and development of new products. The construction and main-

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2 Increases drilling efficiency

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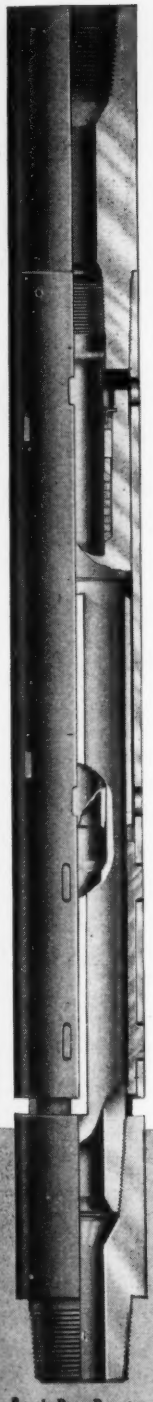

Baash-Ross Bumper Sub—Drilling Type.

WHEN YOU put a Baash-Ross Drilling Type Bumper Sub on your drill string you're installing one of the best safeguards yet developed against costly fishing jobs. For the Baash-Ross Drilling Type Bumper Sub is specially designed with the necessary ruggedness and engineering features to withstand the continuous vibration and severe torque load of modern high-speed drilling operations. A particularly important design feature is its renewable spline inserts that take all of the wear. You can renew this Bumper Sub after long periods of use by simply replacing the spline inserts—a simple and inexpensive operation.

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Renewable spline inserts are just one of several features that make the Baash-Ross Drilling Type Bumper Sub unique and permit it to be used continuously *right in the drill string* with negligible maintenance and attention. Whenever you're drilling in heaving, sticky or difficult formations, install the Bumper Sub directly above the reamer, the bit or other large-diameter sections that are apt to get stuck. Should the drill string stick, you can *instantly* start jarring to loosen it. You can jar *up*... or you can jar *down*. Or you can even alternate up and down jarring, if desired, without making any adjustment whatever in the tool. In addition, you can instantly control the force of the blow—heavy or light—to meet any requirement.

By having a tool *right in the drill string* with which to jar the pipe loose the instant it sticks, one of the major causes of costly fishing jobs is eliminated. The time to loosen stuck pipe is the moment it sticks—not after cuttings have had a chance to settle and wedge the string tightly in place. The Baash-Ross Drilling Type Bumper Sub gives you this split-second safeguard against costly fishing operations.

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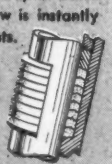
But that is not all. Many operators are also using the Baash-Ross Bumper Sub to increase the efficiency of their drilling operations by installing it as a telescoping "free" joint between the drill collars and drill pipe. Then, by regulating the weight of the drill collars, they can maintain continuous and accurate control on the weight placed on the bit by simply keeping the Bumper Sub joint partly open as they drill. Yet at any time they can immediately increase or decrease the weight on the bit in the normal manner should thin strata of hard or soft formations make such changes advisable.

Regardless of the nature of your drilling operations, you will find the Baash-Ross Drilling Type Bumper Sub an invaluable aid. Get the full details on this tool from your nearby Baash-Ross distributor... or write direct.

Only the Baash-Ross Drilling Type Bumper Sub has all these advantages!

Quickly Renewable Spline Inserts: Replaceable spline inserts take all the wear. After long periods of service, simply replace the spline inserts—a quick and inexpensive operation—and the Bumper Sub is as good as new. Minimizes wear on body and mandrel!

Drives Up or Down: No adjustment is necessary in the tool to jar either upward or downward—or to alternate up or down blows. Also, intensity of blow is instantly variable to meet requirements.



High Pressure Pack-Off: Under even the highest drilling pressures the Baash-Ross Bumper Sub will not leak because of the unique heavy-duty multiple-ring packing element between the body and mandrel. This unit packs off over the full stroke, and may be readily replaced whenever necessary.

16 Inch or 24 Inch Stroke: Take your choice—the Baash-Ross Bumper Sub is available in both 16 inch and 24 inch strokes... or can even be supplied with other length strokes on special order.

Wide Range of Sizes: Available for both API Regular and API Full Hole strings in a complete range of sizes.

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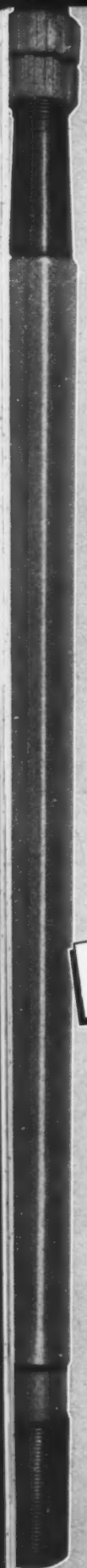
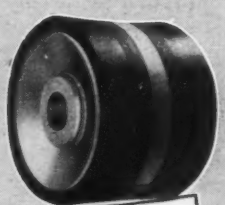


MISSION Super-Surface PISTON ROD

MISSION Self Sealing GLAND PACKING



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The Mission Super-Surfaced* Rod lasts about twice as long as a File Hard Rod under normal conditions because after the Super-Surface* is finally worn away, a high strength, long-life File Hard Rod remains to give another long period of wear.

Corrosion Resisting Super-Surface*

The Mission Super-Surfaced* Rod lasts up to 4 times longer than File Hard Rods under corrosive conditions. Under such conditions ordinary rods pit badly. This pitting and grooving that results, quickly becomes so severe that the rods must be discarded. Mission Super-Surfaced* Rods, however, stay smooth even when salt or brackish wash water is used.

*Registered United States Patent Office.

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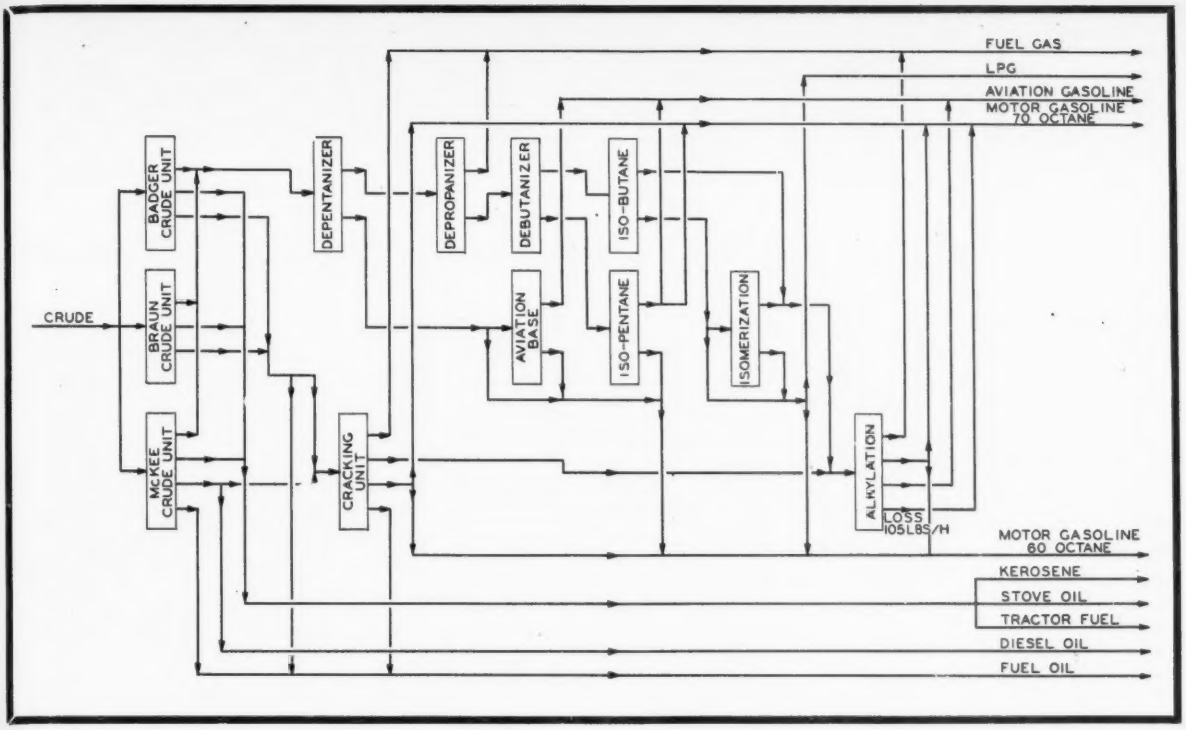

Flow diagram of Atzcapotzalco refinery

tenance department controls material purchases and preparation of the annual operating, maintenance, and capital-expenditure budgets.

The department for plant design develops and supervises all installations, studies processes and equipment, and handles proposals and plans submitted by contractors or outside agencies. Standards and methods for calculating the manufacturing costs, setting minimum prices for export products, and supervision of manufacture of containers are matters handled by the marketing and costs department. The general clerical department has charge of all files and clerical and stenographic work.

Condition of Plants at Expropriation

At the time of expropriation the Ciudad Madero refinery at Tampico in 1938 had three topping units to process 43,000 bbl. of crude per day; a redistillation unit of 14,000 bbl.; a 4,800-bbl.-per-day Dubbs reforming unit (70 per cent of its output of 68-octane number); and a Gyro unit which underwent emergency repairs to produce 600 bbl. per day of additional 68-octane-number motor fuel. New work on this plant has raised its capacity to 57,000 bbl. per day, the redistillation unit to 17,000 bbl. per day, and the paraffin-wax plant will soon make 1,700 tons per month. The Dubbs unit has been converted to a gas-oil cracking unit, a heavy residue cracking unit has been built, and an 8,000-bbl.-per-day stabilizing plant installed. New towers, exchangers, heaters, and other items have been added and the whole plant rejuvenated. A system for condensing gasoline vapors by direct water contact has simplified the gasoline treating and reduced operating costs appreciably.

With a topping capacity in 1938 of 11,500 bbl. of crude per day, the Arbol Grande refinery has been expanded to 23,000 bbl. per day. It now produces lubricants, greases, blown asphalt, and has an entomological laboratory for checking the qualities of insecticides manufactured.

The Mata Redonda refinery, State of Vera Cruz, was one of the poorest plants, having only 8,000 bbl. per day crude capacity in 1937. Expansion has raised it to 13,400 bbl. per day. Poza Rica residue is processed, in a Kellogg cracking unit, and 1,000 bbl. of high-octane-number gasoline per day is produced.

In 1938 the Minatitlan plant had 27,000 bbl. per day crude capacity, a wornout Trumble unit, and a high-vacuum distillation unit of 6,000 bbl. per day. (This latter makes most of Mexico's lubricating-oil components.) All units have been revamped to permit a total throughput of 28,000 bbl. per day. However, currently there is insufficient crude production to operate the plant at capacity. The lubricant fractions are treated by the Edeleanu sulfur dioxide process. The products supply the Pacific Coast and other neighboring areas.

The Atzcapotzalco plant, near Mexico City, was processing 11,000 bbl. per day of crude in 1938. By improving existing units this capacity has been increased to 23,000 bbl. per day, and addition of modern units will raise this to 50,000 bbl. per day by the end of 1946. Then this plant will be able to supply all needs of the central zone for petroleum products, including aviation fuels.

Among vexing problems was that of improving the quality of motor fuel. Direct condensation of gasoline

THE AUTHOR

Carlos L. Corcuera, author of this article, has been in charge of all refining operations for Petroleos Mexicanos from the first day the government took charge of the industry. For 6 years immediately preceding his appointment, he worked for Compania Mexicana de Petroleo "El Aguila" (Shell) as subchief of the cracking plant and superintendent of distillation in the Minatitlan refinery, as chief chemist and superintendent of the paraffin plant at Ciudad Madero refinery, and as relief technician in the various refineries of the company. He is a graduate of College of Jesuits, Guadalajara, Mexico, and of Cambridge University, England, where he spent 4 years and graduated with honors in 1929 as an industrial and mechanical engineer. After a short stay in Spain, he returned to Mexico, entering employ of El Aguila in 1931.

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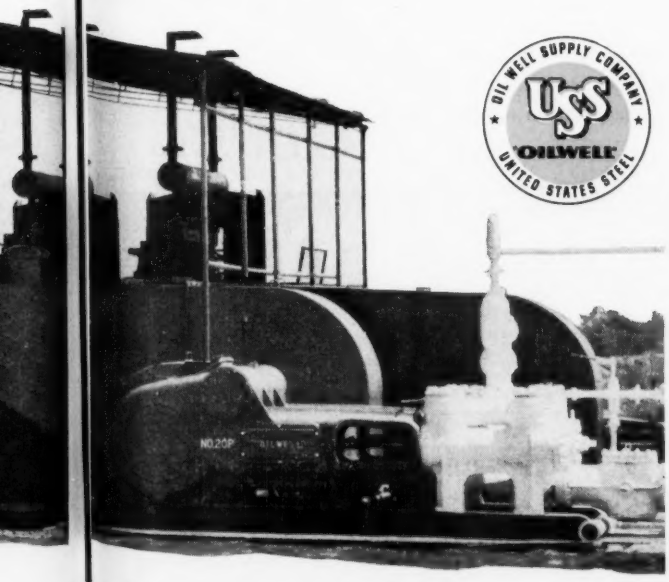

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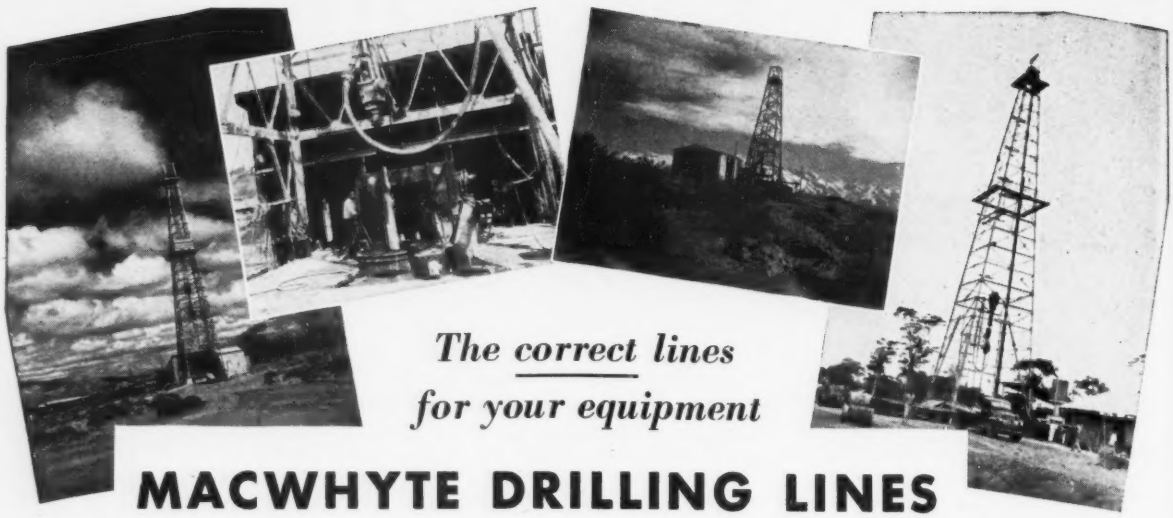

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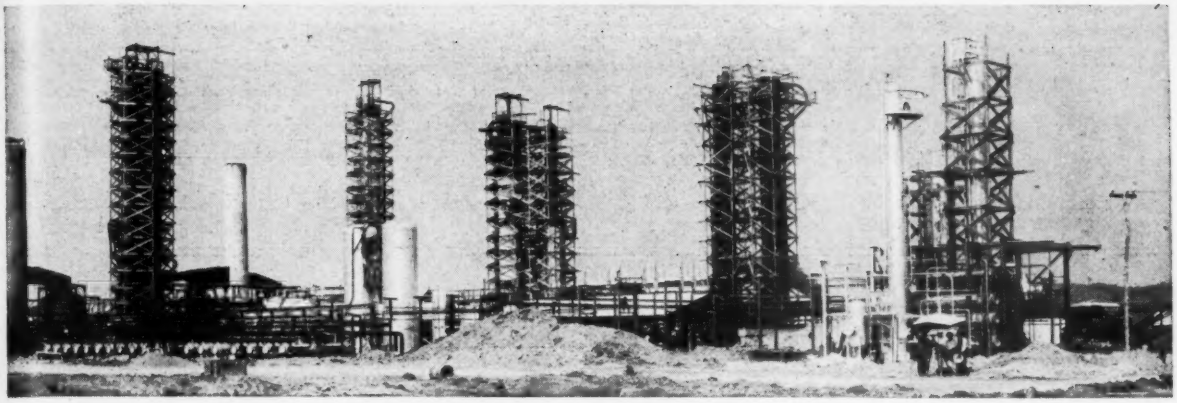


General view of Poza Rica new installations under construction

vapors by injecting water into the vapor space had to be resorted to, in order to avoid severe corrosion of exchanger and condenser tubes, when these tubes in suitable alloys could not be obtained.

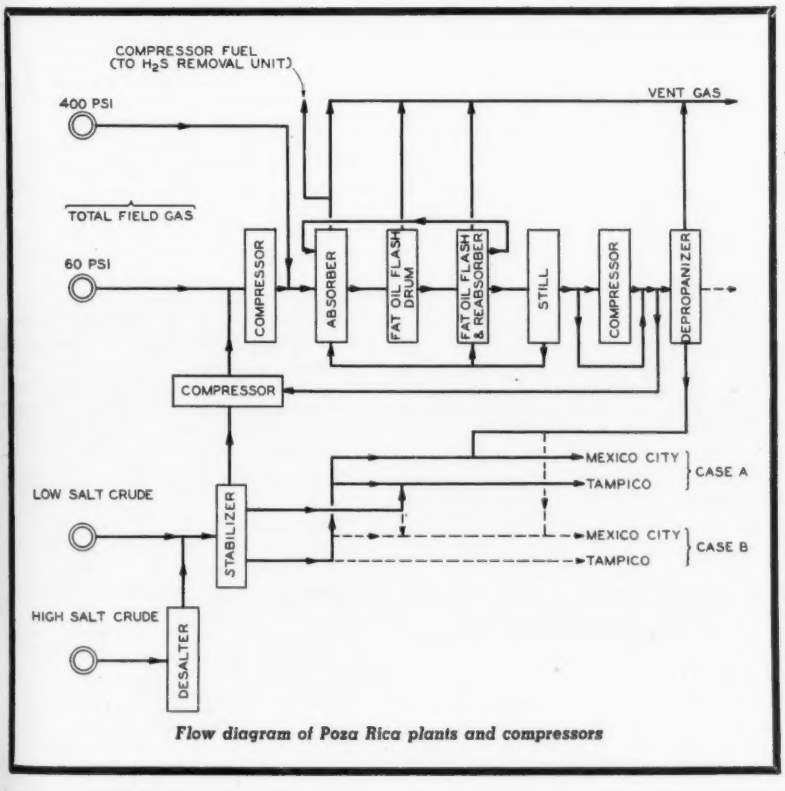
Improved treating methods have raised the standards of these various products. Imported fatty acids for grease making have been replaced by Mexican tallows at great reductions in cost. We have adopted formulas for products which use native raw materials as far as possible.

Repair and Enlargement Program

During 1938 and 1939, with the help of the few engineering companies interested and available, a study was made of our situation and a program developed which included the following items, most of which have now been completed:

1. Repair and modernization of "C" plant at Ciudad Madero to top 25,000-30,000 bbl. per day of Poza Rica crude.
2. Revamping D and E units in this plant to redistill 16,000 bbl. per day and make 6,000 bbl. per day of paraffin distillate.
3. Recondition paraffin plant (same refinery) to make 60 tons of refined wax per day.
4. Modification of B and F units (same refinery) to top 35,000-40,000 bbl. per day of crudes, redistill light residues, etc.
5. Conversion of M tower to produce Panuco and Naranjos asphalt.
6. General reconditioning and rebuilding program for all auxiliary units, steam, electricity, etc., and repair of pumps, lines, storage.
7. Modernization of topping plant No. 3 at Arbol Grande to raise crude capacity from 7,000 to 12,000 bbl. per day.
8. Enlargement of topping plant No. 2 at Mata Redonda refinery, mostly from existing materials, since eventually this plant will be closed.
9. It was planned to enlarge the topping unit at Bella Vista, but later developments resulted in the decision to close this plant as uneconomic.
10. Modernization of No. 2 topping plant and Trumble topping unit, Minatitlan.
11. Installation of new boilers at Minatitlan plant.
12. Installation of a new 10,000-bbl.-per-day topping plant at Atzcapotzalco refinery.
13. Building of a new stabilizing plant (same refinery) to produce liquefied gases for local markets.
14. Installation of a lubricating-oil plant for treating Poza Rica crude, to manufacture lubricants of the paraffinic type.
15. Installation of a new paraffin plant to produce more wax and eliminate need for importing semirefined waxes.

These plans thus include a refinery system, adequate to supply the growing demand for petroleum products in Mexico. Later, doubtless, other refining centers and refinery plants must be built to meet mounting needs. Requirements for petroleum products in Mexico up to 1950 are estimated in Table 1.



Flow diagram of Poza Rica plants and compressors

TABLE 1—DEMAND FOR PRODUCTS
(Barrels per day)

Year—	1946	1947	1948	1949	1950
Gasoline	21,600	25,450	29,800	32,800	34,700
Kerosene	4,256	4,945	5,738	6,651	7,719
Tractor fuel	3,005	3,360	3,756	4,204	4,704
Diesel fuel	3,188	3,463	3,774	4,101	4,463
Heavy fuels	54,846	56,518	58,206	59,929	61,721
Lubricants	1,553	1,786	2,054	2,362	2,716
Paraffin	850	850	850	850	850
Total	89,298	96,372	104,178	110,897	116,873

(Continued on page 256)

Fig. 1—Relief map of Venezuela. The outline of the mountains to the west and north and the highlands south of the Orinoco River reflect the broader aspects of the structural geology

VENEZUELA

No. 2 Oil-Producing Nation

by Charles J. Deegan and Paul Reed

WITH current production at the 1,100,000 bbl. per day mark, Venezuela appears to be maintaining a firm grip on second place among the world's oil-producing countries.

While the Maracaibo Basin continues to produce the bulk of the country's oil, Eastern Venezuela is coming up rapidly, and about two-thirds of the currently active drilling rigs are operating in that area, against one-third in the Maracaibo Basin. This in spite of the fact that the Maracaibo Basin contains large potential sources of oil that are only partially developed, and many very promising prospects.

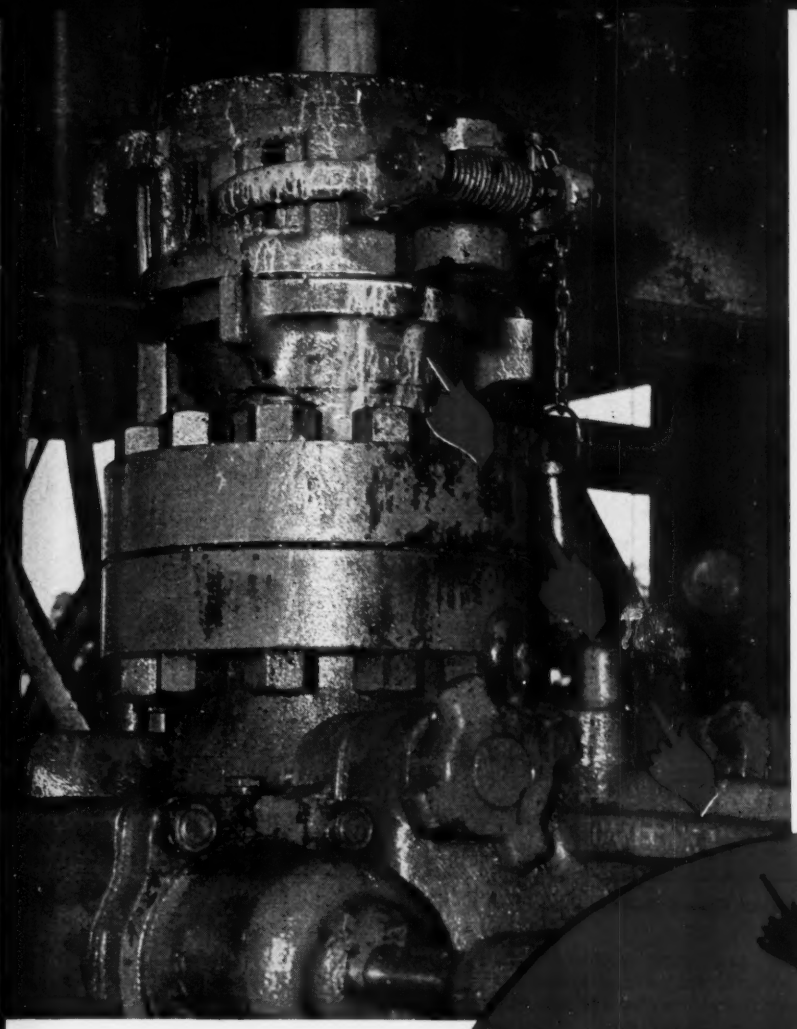
There are good reasons for this concentration of drilling in Eastern Venezuela. First, and important, rich fields have already been found and partly developed. Second, the general terrain is favorable. Furthermore, under the new concession law of 1943, many companies have acquired what are known as "exploration" concessions. These cover a large area, but after 3 years, a part of each concession must be turned back to the government and the remainder converted to an "exploitation" concession. The exploitation concession then remains in effect as long as contract conditions are met.

Therefore companies holding exploration concessions are eager to find out as much as possible about their tracts within the 3-year period. Before surrendering part of each tract, they engage in intensive geological and geophysical exploration and follow it as rapidly as possible with wildcat drilling. Of the total number of active drilling rigs in Venezuela, amounting to somewhat more than 100, approximately a third were engaged toward the end of this year in the Maracaibo area; more than 60 per cent of these were located in the area of the Bolivar coastal fields on the eastern side of the lake; approximately 30 per cent were on the west side of the lake.

Drilling Rigs

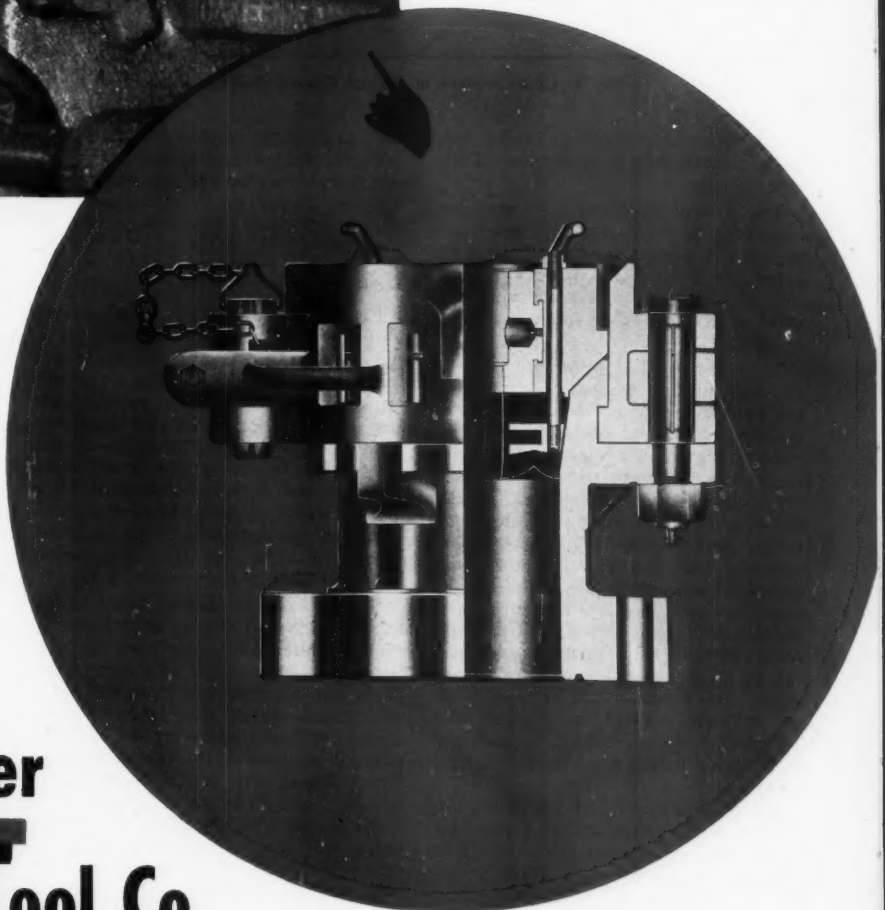
The remaining two-thirds of the Venezuelan rigs, operating in Eastern Venezuela, were mostly concentrated in the Greater Jusepin area which has approximately 45 per cent of the eastern rigs. More than 25 per cent were in the Greater Oficina area. Nearly 20 per cent of the eastern rigs are in the state of Guarico where the extensive wildcatting is being done in this large area where the Las Mercedes field represents the only production. Among the areas where exploration drilling is being watched with interest are Coco Seco, Pelayo, and extensions of West Guara in Greater Oficina; Mata Grande and Punta Gorda in the Greater Jusepin area; Tucupita and La Horqueta in the Orinoco Delta where geophysical exploration is being conducted preparatory to drilling in the vicinity of Pedernales; Zulia, Amana, La Paz, and Mara areas west of Lake Maracaibo; and extensions to the Bolivar coastal fields on the east side of Lake Maracaibo.

The result of this concentration of attention on the eastern part of the country has been to increase its relative importance in Venezuela's total production, even at a time when the Maracaibo Basin production was increasing. Of the current production, about one-third is now coming from the eastern fields and two-thirds from the Maracaibo area. Since, up to the end of 1945, of the country's total cumulative production, only one-fifth had come from the eastern part, it is obvious that that part of the coun-



PICTURE OF AN OPERATOR

TAKING NO CHANCES



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Cross-section view of an O-C-T Type "H" Blowout Preventer, equipped with a regular drill pipe packoff.

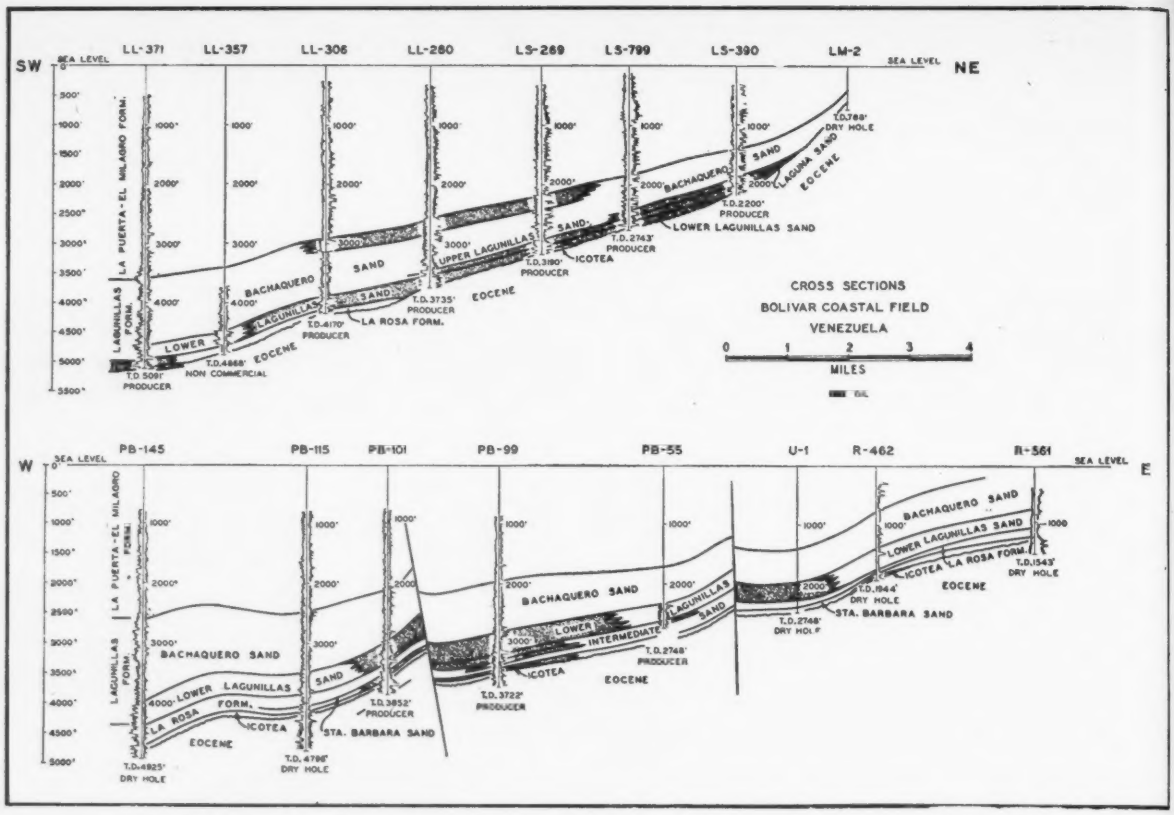

Fig. 2—Cross sections of Bolivar Coastal fields in the east side of Lake Maracaibo (Courtesy A.A.P.G. Bulletin)

try is currently growing more rapidly in importance than the Maracaibo Basin.

The proven reserves of Venezuela, according to competent authority, are at least 8 billion barrels. This gives a ratio of reserves to annual production of about 20 to 1, compared to a ratio of around 12 to 13 in the United States.

There are sound economic reasons for this higher inventory ratio. Besides distance from the sources of equipment and supplies, there is the necessity of making large capital investments in constructing pipe lines, refineries, export terminals, roads, housing, schools, communication systems, and providing an extensive training program to utilize the national labor supply. These are necessary in order to turn crude-oil production into dollar income. To justify these investments, large proven reserves of oil must be in sight in advance. As a result, the producer has an indirect capital investment per barrel of daily production much higher than he would have in the United States.

By their activity, the operators appear to be convinced that future demand for Venezuelan oil is likely to increase, and therefore further expansion of their reserve inventory is desirable, in order to justify the increased capital investment in indirect producing facilities. This is expensive, but as long as the fields that are found develop enough reserves to support it, the extra investment per barrel of daily production can be justified.

Geology

Fig. 1 is a relief map of Venezuela and the outline of the mountains to the west and north and the highlands south of the Orinoco River, as so often happens in Tertiary country, reflect the broader aspects of the structural geology. The location of the Maracaibo Basin in the west, lying between two forks of mountain folding, is quite obvious. Here the geology and the topography on a broad scale are alike, for the topographic basin is also a geological basin.

The relation of the oil fields to the topography and the geological basin of the Lake Maracaibo area is comparatively easy to see on a relief map. It is not so apparent that the eastern plains region also represents an enormous basin area, but it does. The present course of the great Orinoco River marks the southern boundary of this basin. The mountains east of Lake Maracaibo and their extension along the north coast line mark another boundary. Southwestward this basin swings into the llanos region of Colombia. Eastward, the basin extends to the ocean at the delta of the Orinoco River, just opposite the island of Trinidad.

The highlands just south of the Orinoco River, known as Guayana land, are an extension of the Brazilian shield. They are part of an ancient land mass, composed of igneous and highly metamorphosed rocks. They have existed as a land mass since probably early Paleozoic time, never covered by the sea.

In the great basin area of Eastern Venezuela, the seas covered the entire area from the present ocean on the north to Guayana land on the south. The deposition of sediments thinned and wedged out against Guayana land, becoming thicker and thicker away from that land mass. Later, the present mountain areas both east and west of Lake Maracaibo and along the north coast were uplifted, and in rising, folded and crumpled the sediments, most intensely in the mountain cores, decreasingly so toward Guayana land. In addition to the Maracaibo Basin, they also formed the great west-east basin in the present plains area.

This greater Eastern Venezuela Basin is known to be divided into at least two parts, an eastern portion and a west and southwest portion. A line drawn through igneous rocks on the Paraguana Peninsula and at El Baul has been regarded as representing where the Greater Eastern

Venezuela Basin is divided. The eastern part, often called the Orinoco Basin, beginning west of the most westerly oil field in the plains region, extends to the Orinoco River delta and the Atlantic Ocean. The west and southwest portion, often called the Apure or Barinas Basin, extends into the llanos of Colombia.

On the east side of the Maracaibo Basin, as shown in Figs. 2 and 3, the relation of topography and geology is so close, considered regionally, that the position of the oil fields around the rim of a geological basin can be readily seen. Some are structural, some are stratigraphic traps along the wedge out of the sediments against the mountains.

The discovery of prolific production in Cretaceous limestones west of Lake Maracaibo has led to extensive development in the La Paz and Mara fields. The La Luna-Cogollo limestone being exploited there is regarded as comparable in age to the producing limestones of Panuco in the lower fields of Mexico. Shallow production at La Paz is obtained from Eocene sands and from the Guasare interbedded sands, shales, and limestones at depths of 2,000-3,000 ft. These sands lie above the Cretaceous La Luna-Cogollo productive limestone which ranges from 4,500 to 6,000 ft.

In the Orinoco portion of the greater Eastern Venezuelan Basin, the search for oil fields starts with two guide points: (1) Guayana land on the south is almost a hopeless prospect; (2) in the core of the northern coastal mountains, the folding has been too intense, or all sediments have been eroded or pushed aside by granite intrusion.

Furthermore, since the sedimen-

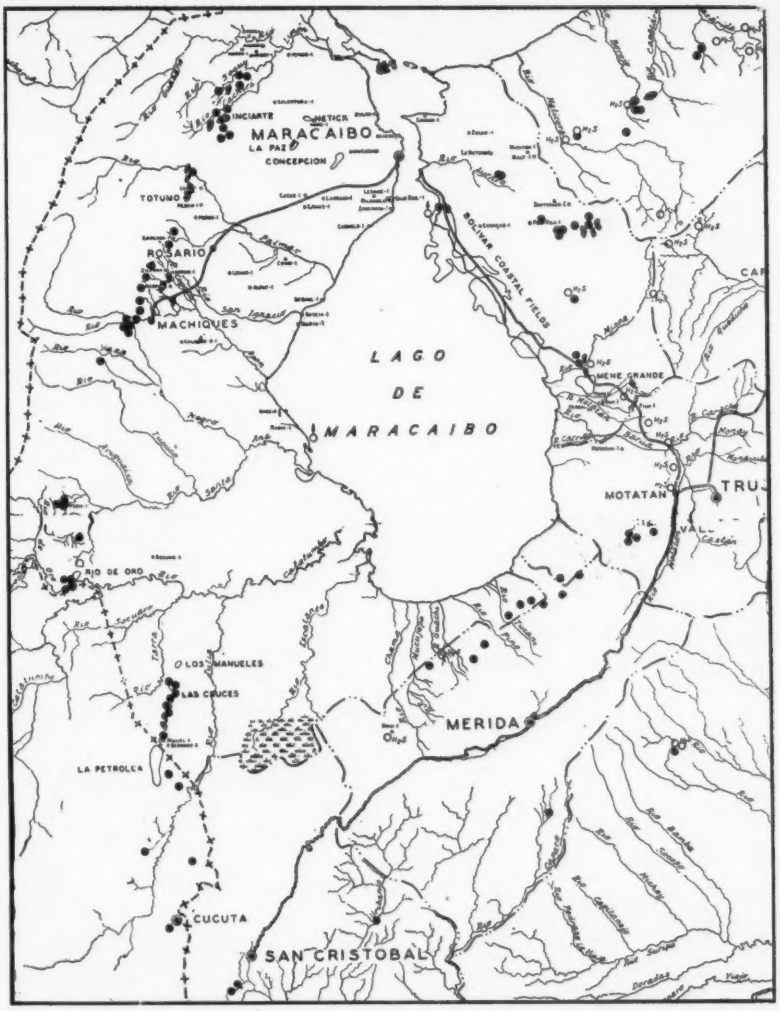

Fig. 3—Maracaibo Basin seepage map (Map and table below courtesy A.A.P.G. Bulletin)

OIL FIELD SUMMARY - MARACAIBO BASIN

Name of Field	Location State of Zulia Venezuela	Owners and Operators	Discovery Date	Discovery Method	Producing Formations	Type Accumulation	Number of Wells Drilled: Prod.	Dry	Total	Grav. Range Deg. A.P.I.	PRODUCTION-BARRELS: 1943	Total to Dec. 31, 1943	Proved Acres (APPROX.)
BOLIVAR COASTAL	Dist. of Bolivar Lake Maracaibo	Creole Mene Grande Ven.Oil.Conc.	1917	Drilling	Misoa Potreritos Las Flores Icotea La Rosa Lagunillas	Stratigraphic and Structural	3905	95	4000	10-30	186,861,350	2,138,339,129	175,000
LA CONCEPCION	Dist. Maracaibo	Ven.Oil.Conc.	1925	Surf. Geol.	Las Flores,	Structural	141	6	147	29-40	1,355,106	29,118,993	1,872
LAS CRUCES (TARRA)	Dist. of Colón	Col.Dev.Co.	1916	Surf. Geol.	Angostura Misoa Paují	Structural	144	25	169	19-37	3,873,367	58,530,384	2,578
LOS MANUELES	Dist. of Colón	Col.Dev.Co.	1927	Surf. Geol.	Misoa Paují	Structural	32	4	36	29-37	1,933,283	35,821,610	801
LA PAZ	Dist. Maracaibo	Ven.Oil.Conc.	1925	Surf. Geol.	Capacho La Luna Guasare Potreritos	Structural and Stratigraphic	76	6	82	13-35	8,049,038	19,195,804	2,344
MENE GRANDE	Dist. of Sucre	Caribbean	1914	Surf. Geol.	Misoa Paují Isnotú	Structural	482	19	501	14-30	12,831,103	978,283,963	10,450
METICK	Dist. of Mara	Orinoco	1929	Surf. Geol.	Potreritos	Structural	3	3	6	21-29	146,022	346,996	154
TETORES (MARA)	Dist. of Mara	Caribbean	1943	Surf. Geol. and Core Drill.	Capacho La Luna	Stratigraphic and Structural	2	1	3	29	1,140,466	1,140,466	250
AMARA (1)	Dist. of Mara	Mene Grande	1928	Surf. Geol.	Potreritos	Structural	1	1	2	31	--	31,362	357
LOS BARINCEOS (3)	Dist. of Sucre	Creole	1922	Surf. Geol.	Eocene	Stratigraphic	2	3	5	16-22	--	96,280	--
MISOA (3)	Dist. of Sucre	Creole	1921	Surf. Geol.	Misoa	Structural	2	2	4	15	--	8,000	--
RIO DE ORO (1)	Dist. of Colón	Col.Dev.Co.	1915	Surf. Geol.	Angostura	Structural	3	1	4	26-28	--	34,877	332
TOTUMO (2)	Dist. of Perijá	Creole	1914	Oil Seepages	Basement Erosion Surface	Stratigraphic	11	1	12	19-21	--	149,352	741
							All Others		113				
					TOTAL BASIN (VENEZUELA):		4804	167	5084		216,189,735	2,611,417,116	194,659

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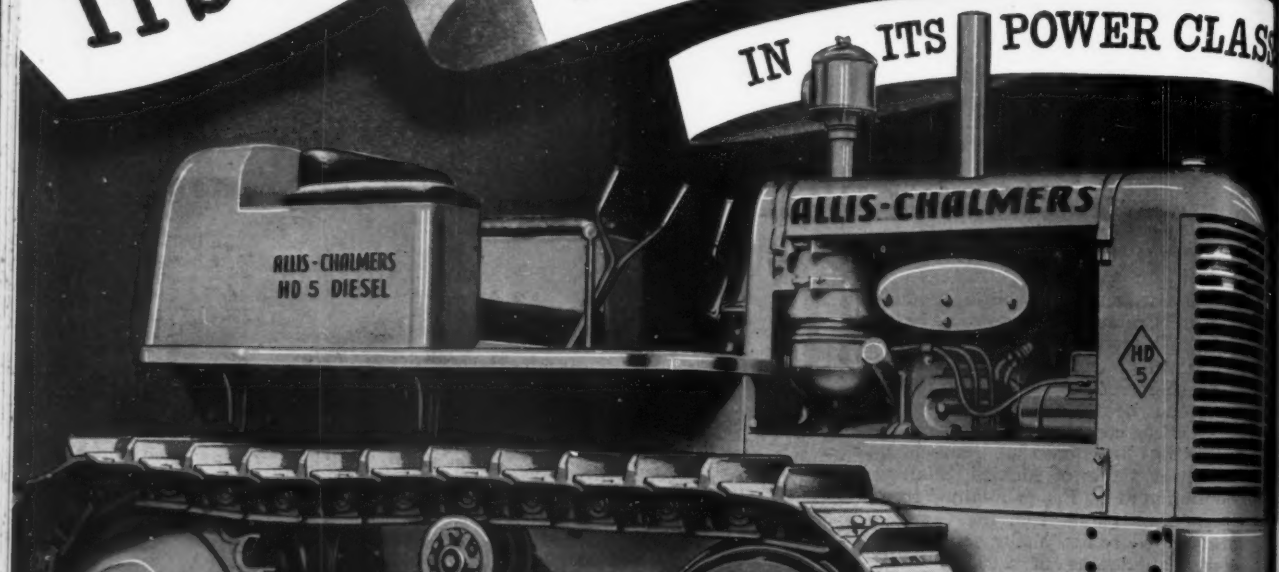

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tary section thins toward the Orinoco River, exploration starts far enough away from the river to get a thick section. Between these two marker points, the search proceeds and thus far results indicate that oil fields can be found as far north as the southern front of the mountains; out in the basin, as far south toward the Orinoco River as the sedimentary section remains thick enough. Wells drilled too close to the river find tar and dead oil in the sands. Three major geologic types of fields have been found: structural folding, stratigraphic traps, and fault blocks.

Most of the fields in eastern Venezuela produce from Oficina sands of the Miocene age. These fields, in addition to those of the Greater Oficina area itself, include those of the San Joaquin, Temblador, and Tucupita areas. While the sands penetrated at Las Mercedes are said to have no direct relation to the Tertiary section in eastern Venezuela fields, they have been regarded as Oficina formations.

The Greater Oficina fields, referred to as of the fault-block type, located on the south flank of the Eastern Venezuela Basin, may be considered as both structural and depositional with the reservoir rock being more or less broad sheet-like bodies of sand rising gently and rather uniformly southward and southwestward from the basin. The effective barriers for oil accumulation are: (1) Faults normal to the direction of the dip in this part of the basin; (2) lateral decreases in permeability; and (3) pinching out of the strata updip.

Conditions in the Greater San Joaquin area north of Oficina have been compared with those in the Seeligson-Stratton area on the Texas Gulf Coast. While sands in the Greater Oficina area are from 4,000 to 7,000 ft., in the San Joaquin area they are from 6,000 to 11,000 ft., where the deepest production in South America is found. Production comes from steeply dipping beds of the Oficina section, having many barriers due to faulting which mean that few of the producing formations may be regarded as blanket sands.

The Miocene sand in the Jusepin and Quiriquire areas was deposited more recently than the Oficina series and is not present in the Oficina and San Joaquin areas just mentioned. Jusepin, which has been compared to the East Texas field, is really produced largely from three Miocene marine lenses. Fields of the Greater Jusepin area including Mulata, Travieso, and Santa Barbara cover several thousand acres. Sediments are believed to have originated in the north coastal range. Some Jusepin production comes from Oligocene truncated beds dipping southwestward. Sand conditions in the Miocene producing formations are not simple. Abrupt changes due to numerous faults of small displacement make it necessary to correlate carefully over large areas.

The Quiriquire field is unique in producing from petroliferous beds in Pliocene and Pleistocene detritus (never affected by marine, lacustrine or deltaic influences) deposited on Cretaceous and Tertiary truncated beds. Temblador and Tucupita have been compared to the Luling, Texas, field. At Las Mercedes production is mostly from La Pascua sand (Miocene) having three zones. One well is dually completed in the La Pascua and in a Cretaceous sand found at a structurally high location at a depth of 5,100 ft., which is reported to be the first and only Cretaceous well east of the Maracaibo area.

Two other general points should be mentioned. First, the sedimentation conditions in the basin are complicated by the fact that apparently the delta of the Orinoco River in past geologic times was much farther west than at present, so that deltaic sand conditions are found in places in the basin which would normally carry a different type of sediment. The other item is that the axes of the structural folding and of the fault systems do not appear to parallel the present mountain folding, but have a different angle. There is some evidence that their trend may be controlled by basic lines of weakness or grain in ancient Guayana land.

Notable folding has been observed

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to extend along a southwest-northwest line running through the Greater San Joaquin area and a Cretaceous hill west of the Jusepin area.

Because so many of the oil reservoirs are in relatively young and soft Tertiary formations, which have been subjected to folding and crumpling by mountain making forces, many seepages of oil are found, both in the Maracaibo Basin and in Eastern Venezuela.

The most important geologic factor in Venezuela, both western and eastern concerns the item about which petroleum geologists still know very little. What general, but basic, set of conditions is required to have large quantities of oil formed and accumulated? Whatever they are, they existed to a high degree in Venezuela during probably both Cretaceous and Tertiary time, and the result is that many prolific oil fields have been found and many others are almost certain to be found in the future.

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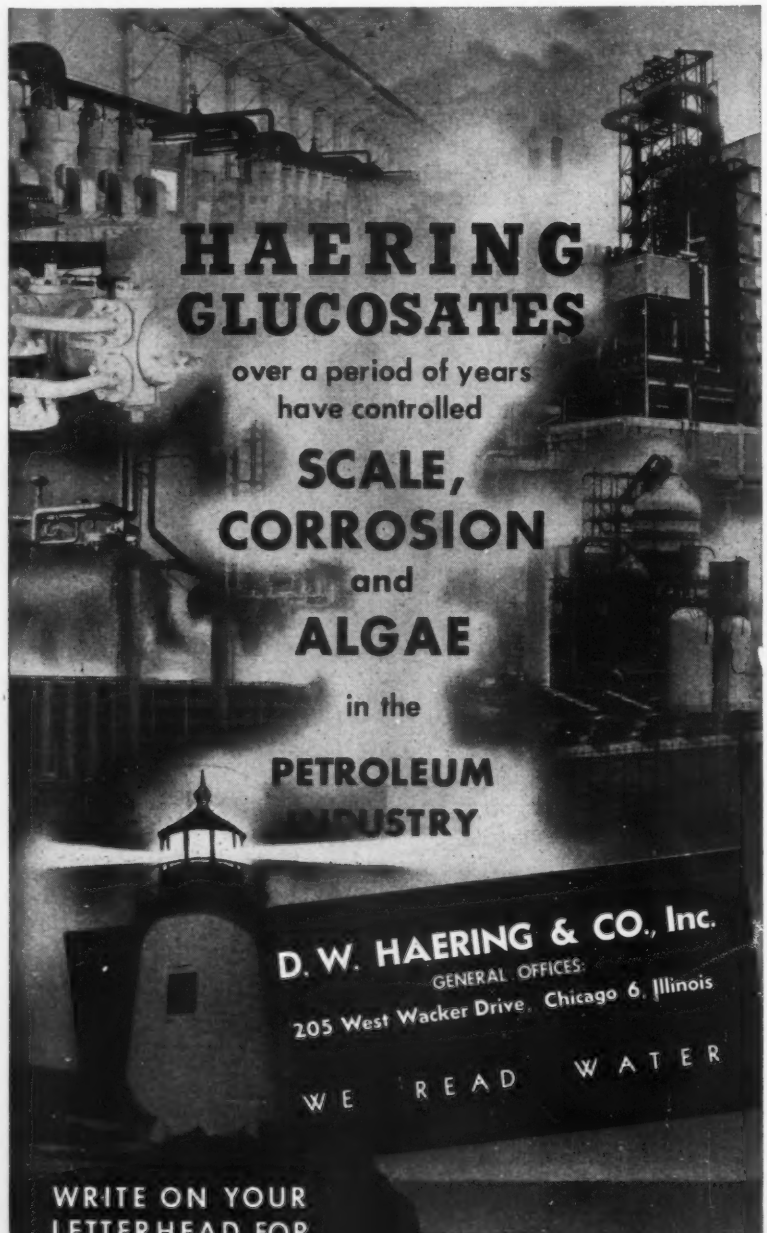

Heavy Fuel-Oil Market Booms in Netherlands

Heavy fuel oil consumption in the Netherlands in July was 27 times the average monthly consumption in the period August 1938 to August 1939, according to information published in the Foreign Commerce Weekly, publication of the Department of Commerce. Demand for the fuel is due almost wholly to the critical shortage of coal.

Consumption of other petroleum products for the same period included: motor gasoline, up 8 per cent; kerosene, up 5 per cent; black oils, gas oil, diesel oils, and light fuel oil, down 24.5 per cent; and lubricating oils and greases, up 34 per cent.

China's Potential Oil Resources Large

by Gustav Egloff*

CHINA is essentially an agricultural country at the present time. Its mineral resources have not been developed to their fullest capacity and the country has not been industrialized as yet in the modern sense. About one-third of its total area, which is 50 per cent greater than that of the United States, has undergone geological exploration so that any estimates of mineral resources are incomplete and must be considered as preliminary. For China to emerge as an industrial nation in keeping with its civilization, population, area, and resources, will require extensive use of modern science and technology. The country is beginning to recover somewhat from the ravages of 9 years of war, and projects leading toward better utilization of its resources are under way.

The limited exploration of China's mineral resources applies with particular force to its mineral fuels. Geological surveys have located large deposits of coal, oil shale, and natural gas, but explorations for petroleum have been limited for the most part to a few areas characterized by oil seepages and favorable structures. These follow generally a 2,000-mile arc extending from Sinkiang through Kansu and into Sczechwan and Shensi provinces. The areas thus far studied indicate that China's petroleum reserves are about 2,000,000,000 bbl., but further geological surveys embracing the whole country will most likely show far greater volumes.

At the present time, the oil-producing or oil-bearing areas of China are found in seven basins. These are: (1) the Tsungari Basin, (2) Tarini Basin, (3) North Kansu Basin, (4) North Shensi Basin, (5) Sczechwan Basin, (6) North Manchuria Basin, and (7) East Jehol Basin. These extend from northwestern Sinkiang province in the Gobi desert in a general southeasterly direction through the provinces of Kansu, Shensi, and Sczechwan to coastal areas surrounding the cities of Hangchow and Canton. The first two basins are in Sinkiang province, the third is in Kansu, the fourth in Shensi, the fifth in Sczechwan, and the last two in Manchuria. In addition, there are reportedly 11 more probable oil-bearing areas.

The principal difficulty hindering full exploration and exploitation of the potential oil-bearing areas is poor transportation since the prospective oil fields are largely in the northern and western portions of the country where highways and railroads are lacking and where desert and other adverse climatic conditions prevail so that all supplies must be hauled in by motor-driven or animal-drawn vehicles. For the most part China's fuel reserves are at distances from 500 to 1,500 miles from the densely populated centers on the east and southeast coasts. Transportation is therefore one of the cardinal problems of China.

The first attempts to form any estimates of China's petroleum reserves were made in 1920 by American oil men. They investigated the provinces of Shensi and Sczechwan and placed the petroleum reserve in these provinces at 1,375,000,000 bbl. In 1934, the National Geological Survey of China estimated that the proved oil reserves of China proper were 2,227,000,000 bbl. which included 1,375,000,000 bbl. in Shensi and Sczechwan provinces and 852,000,000 bbl. of oil recoverable from Shensi oil shale. Adding 2,110,000,000 bbl. obtainable from the four northeastern provinces made a total of 4,337,000,000 bbl.

The latest estimates made by Chinese geologists in 1946 are given in the accompanying table.

The most important field in China today is the Yumen oil field which was discovered in 1939 in the northwestern portion of Kansu province.

PRESENT ESTIMATE OF OIL RESERVES OF CHINA
(42-gal. bbl.)

Sinkiang	844,200,000
Kansu	150,000,000
Shensi	16,400,000
Sczechwan	600,000,000
Manchuria	10,000,000
Total	1,620,600,000

The field is 900 air-line miles from Chungking and 1,550 miles from it by road. This field has undergone the most extensive development of any Chinese oil-producing area. Production was at the rate of 2,100 bbl. a day in 1942. Early in 1944, production attained a value of 3,000 bbl. a day which accounted for most of China's crude-oil output. The Yumen field is on the edge of the Gobi desert and its elevation is from 8,000 to 8,300 ft. above sea level on the northern side of the Nanshan mountains. Living conditions are rather difficult. There is practically no vegetation and all food supplies and equipment must be brought in by trucks. Beside the retarding influence of the natural environment, development of the field was hindered because of stoppage of shipments of equipment and supplies for drilling and refining resulting from the blockade of the coast and loss of the Burma Road to the Japanese.

The first drilling of oil in Yumen was done near oil seepages that have

Map of China, showing location of Yumen field

*Universal Oil Products Co., Chicago.

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been known for many centuries. The small river that cuts through a gorge near the crest of an anticlinal structure has been known for 2,000 years as the Shihyouho or "rock oil river." The first shallow well yielded oil as a pumper. The first seven wells which were drilled with cable tools produced oil at depths of from 200 to 550 ft. Of the first seven wells drilled, six have been abandoned. Deeper drilling with diesel-powered rotary equipment found oil at a depth of 1,450 ft., the first well coming in out of control so that it caught fire and burned the derrick and other equipment. By 1944, 14 wells had been drilled to depths of 1,300 to 1,400 ft. and 6 of these produced oil at the rate of 500 bbl. per well per day. By the early part of 1946, a total of 26 wells had been drilled. At this time, 12 wells which were operated to produce oil for refinery needs had yielded an average of 120 bbl. per well per day over the preceding 21-month period. In 1945, daily production figures from all 26 wells varied from 1,500 to 2,200 bbl. daily.

Productive Area

According to one estimate, if an average sand thickness of 83 ft. is assumed along with 60 per cent ultimate oil recovery, the Yumen field should produce more than 45,000,000 bbl. of oil from a proven area of less than 600 acres. However, a later independent estimate assumes a productive area of 1,375 acres and an ultimate recovery of from 89,000,000 to 100,000,000 bbl. of oil from the "L" sands, which comprise the principal producing zones. The initial shallow producing zones were known as the "K" sands and these do not figure in the reserve estimates. The "L" sands are in turn divided into "L_1" which is 5 ft. thick at a depth of 1,353 ft. and the "L_2" sand which is 57 ft. thick at a depth of 1,480 ft. Up to February 1945, the last date for which accurate figures are available, the Yumen field had produced a total of 1,379,000 bbl. of which 1,347,000 bbl. had come from the "L" sands. The deepest well was drilled to a depth of 2,160 ft. This well went through a producing zone at 1,638 ft. which was 56 ft. thick and currently designated as the "M" sand.

The crude oil produced in the Yumen field (now generally characterized as the Laochunmiao field) has an A.P.I. gravity of about 32.5°, a pour point of 50° F. and 0.15 per cent sulfur. It contains about 15 per cent wax which deposits in the well tubings so that they require frequent scraping and cleaning. Steam heating of tanks and transportation lines is also imperative if continuous operations are to be assured.

Two refineries have been erected in the Yumen field. One has three batteries of batch shell stills for producing straightrun distillates and the other has a pipe still and cracking unit. The first refinery operates as a topping unit and the second produces gasoline, kerosene, diesel oil, wax, lubricating oil, and fuel oil. The crude oil yields about 21 per cent of straightrun gasoline. Some of the wax is made into candles for use locally and the remainder is shipped to Chungking. Residual fuel oil is used as much as possible for refinery fuel and general heating purposes. The gasoline and other products are trucked 400 miles to Lanchow.

The province of Sczechwan in which Chungking is located contains what is known as the Red Basin, which is 60,000 sq. miles in area and constitutes nearly one-half of the province, being about the size of the state of Oklahoma. The south and southeast portions of this designated area contains about 100 anticlines which run generally in a northeasterly to southwesterly direction. The average surface elevation is about 1,000 ft. above sea level. Very little detailed geologic prospecting has been done. The province is predominantly agricultural but has extensive coal deposits and salt wells. Salt brine wells in the area are from 2,000 to 3,000 ft. deep and small amounts

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of oil are obtained with the brines. The area produces most of China's salt. One well has yielded as much as 10 bbl. of oil per day but most of them only a few quarts. Limited information about the oil produced at Mioerhkow in western Sczechwan province indicates that it is high in gravity and low in sulfur but yields only about 2 per cent straightrun gasoline.

Natural gas accompanies the sal brines and is used as fuel for evaporating them to produce salt. About 350 wells are producing brine and about 2,800,000 cu. ft. of natural gas daily. The gas comes from Triassic formations. One of the wells has produced as much as 500,000 cu. ft. of gas per day. The Tzzeliusing gas field in the southern part of the Red Basin is the site of perhaps the oldest gas field in the world from the standpoint of commercial use. One field has been producing for more than 2,000 years. Two hundred and ten wells produce only gas, 96 produce yellow brine, and 46 black brine.

In 1936 the National Resources Commission of China drilled four wells for oil using German rotary rigs. One well was a dry hole, one was not completed due to need of the equipment elsewhere, and the other two wells produced gas. One yielded a half million cubic feet of gas in 25 hours shortly after coming in. The shut-in casing pressure was 1,550 lb.

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In 1941, the well came in and in December 1945 was being controlled to produce 37,000 cu. ft. of gas per day under a casing pressure of 1,140 lb. The other gas well had an original open flow rate of 5,000,000 cu. ft. of gas per day and a closed-in pressure of 1,175 lb. This latter gas had a gasoline content of 0.11 gal. per 1,000 cu. ft. Some of the gas from these wells was bottled under well pressure and used in Chungking for motor fuel. Some was used in engines in ferry boats crossing the Yangtze River.

The oil possibilities of the Red Basin in Sczechwan province look favorable but require much more exploration study. The original exploration and well drilling in the Wu Su field in northwestern Sinkiang were conducted by the Russians who supplied both engineers and well-drilling crews under arrangements between the Chinese and Russian governments. This field is located about 200 miles from Russian Turkestan. The climate is cold and dry and the soil completely unproductive and hardly a more difficult spot could have been found for the development of an oil field and the maintenance of living conditions for drilling crews. Reports of development work are incomplete and sometimes conflicting because of wartime and international secrecy but evidently some oil was found at several localities between 1937 and 1941.

At some time between 1941 and 1943, the Russians abandoned the area taking their equipment with them and turned over to the Chinese about 25 capped wells which had been producing oil of 49°-52° A.P.I. gravity from an average depth of about 4,800 ft. It is reported that heavy gas flows accompanied the oil and that straightrun gasoline produced from the crude had an octane rating as high as 80. There are oil seepages at half a dozen or more localities and indications are that this far distant region has some of the best oil possibilities of all China. South of the presently developed field is another large basin still undeveloped where there is strong likelihood of finding oil. Little data are available as to the former production rates of the present capped wells or the condition of drilling, storage, and transportation equipment in the Sinkiang area.

The north Sinkiang producing area comprises the Tsungari basin. Some of the wells on the southern edge of this basin have been reported to yield from 75 to 225 bbl. of crude oil a day. In the southern part of Sinkiang in the so-called Tarini basin there are seepages in the north and east portions but no organized prospecting has been conducted. Development will necessarily be slow on account of the remote location.

The north Shensi oil basin has shown oil in small pools but no large production even after considerable drilling. While some oil has been found in the north Manchuri and east Jehol basins, the extent of development is not known at the present time.

There are other probable oil-bearing basins in China. The Turfan basin in eastern Sinkiang province has an asphalt deposit which was recently discovered and it is hoped that further prospecting will reveal petroleum. The Tsaidam basin across the Nanshan range from the Yumen field apparently has oil possibilities from a geological standpoint. The south Kansu basin has indications of oil-bearing rocks. Other possible areas for development are found in northwestern Kueichow, in western Yunnan, in Kwangsi, and in Manchuria.

Since the island of Formosa, which was in the possession of Japan for 50 years, has been restored to China, its oil and gas resources are now open to Chinese development. The exact extent of petroleum and natural-gas reserves is uncertain. The island has not been explored by geophysical methods. An extensive exploration program is projected.

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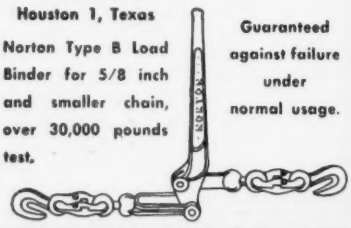

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Seven oil-producing structures were discovered on the western side of the island. Three of these are situated near the town of Byoritsu in the northern part of the island. In the three northern fields, a total of 224 wells has been drilled of which 143 produced gas and/or oil. Sixty-four wells were dry and 16 were not completed because of drilling difficulties. The wells varied in depth from 650 to 3,275 ft. A few in the Kinsui field have been drilled below 12,000 ft. Twenty-six wildcat wells ranging in depth from 825 to 9,900 ft. were found to be dry and were abandoned.

Only three of the seven fields have produced oil in commercial quantities. From 1936 to the end of 1945, a total of 300,000 bbl. of crude oil has been obtained which averages about 80 bbl. a day. The production of gas in the same period has been a little less than 7,000,000 cu. ft. per day. This gas has been passed through absorption plants to yield about 50 bbl. of gasoline per day.

Principal oil production in Formosa is from the Shukkoko field in the northern part of the island. Production figures on Formosan crudes are from Japanese sources. Production of crude oil in Formosa has apparently never exceeded 50,000 bbl. yearly since 1930. The proved resources of the island are not large, however, the geological structures indicate large potential quantities of crude oil and natural gas. The crude oil is a wax-bearing naphthene-intermediate base oil containing very little sulfur and asphalt. Crudes from varying depths range from 30-39 A.P.I. gravity and have pour points of from 35° to 50° F. The sulfur content is about 0.15 per cent and the wax content from 2.9 to 5.5 per cent. Straightrun gasoline of 350° F. end point varies from 35 to 50 per cent and kerosene of 527° F. end point from 30 to 37 per cent.

Substitute Fuels

During the war, China resorted extensively to substitute motor fuels. Alcohol was used to a large extent and gasoline made by the cracking of vegetable oils such as rape seed, tung, and other oils. The Chinese National Resources Commission operated 10 alcohol plants in 1943, 5 of them in Sczechwan province which was a ready source of agricultural material for fermentation processes. At that time, it was reported that these plants could produce over 70,000 bbl. of ethyl alcohol a year. In Chungking in the same year, 11 plants had started to produce motor fuel by the cracking of tung oil. In 1940, the Chinese National Government synthetic oil plant at Chungking was converting vegetable oils into gasoline, diesel oil, and lubricants. Monthly production rates were estimated to be 300 bbl. of gasoline, 750 bbl. of diesel oil, 25 bbl. of lubricating oils, and 2 tons of greases. Motor fuel was produced from coal carbonization, by high-pressure hydrogenation of coal and by the absorption and compression of natural gas.

Production of oil from Fushun (Manchuria) shale was 15,460 bbl. in 1934. This volume of oil, in 1939, had increased to over 2,000,000 bbl. The oil-shale reserve is 5,500,000,000 tons, equal to 2,109,000,000 bbl. of oil while the Shensi oil-shale reserve is 5,000,000,000 tons, equivalent to 852,000,000 bbl. of oil. There are other large oil-shale deposits in China.

China has an estimated 240,000,000,000 tons of known coal reserves and further geological prospecting may disclose still larger quantities. Most of China's coal is bituminous and the great majority of it is found in Shensi and Shansi provinces. The output of coal from the Fushun district near Mukden has been above 10,000,000 tons yearly since 1938.

One can conclude from a study of China's potential mineral fuel resources that they are very large. Scientific and technical knowledge is available to locate more oil, natural gas, oil shale and coal areas. Processes are known for converting these raw materials into useful products which fit into the economic needs of China.

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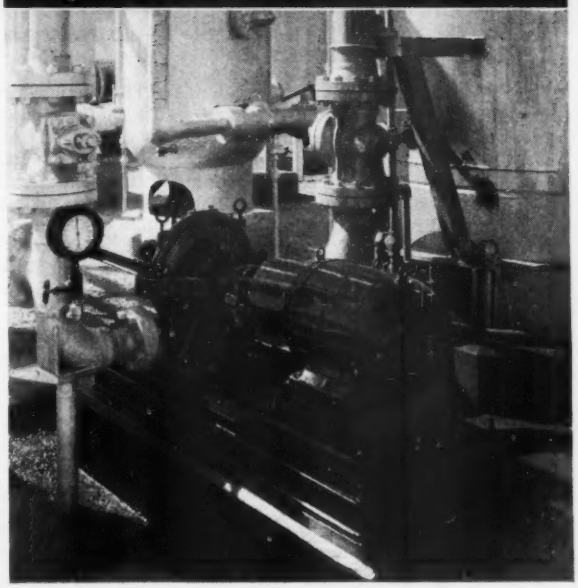

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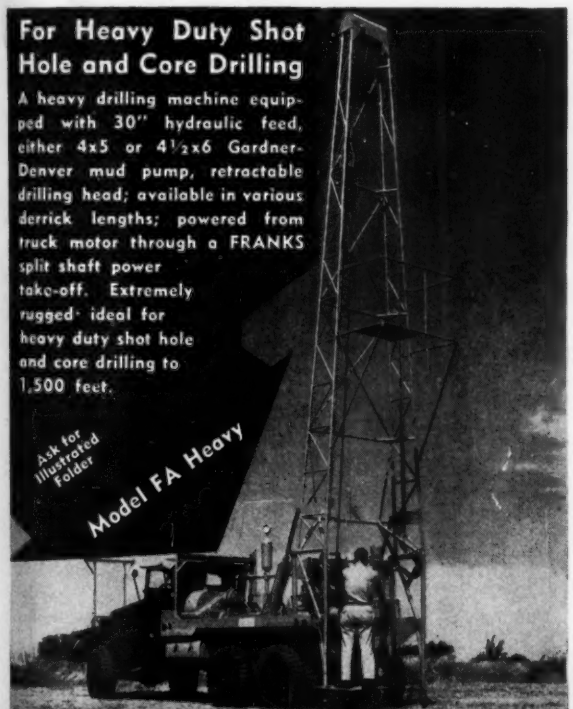

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Swedish Method of Manufacturing Liquid Fuel From Low-Grade Shales

by Sven V. Bergh*

THROUGH World War 2 Sweden was forced into a rather severe situation as to fuel. Even in normal peacetime the country has to import most of its fuel. About 94 per cent of its supply of coal and about 100 per cent of its supply of liquid fuel have to be brought from abroad. The war rapidly caused a successive blockade of this import of fuel. Dr. Gustav Egloff, of Universal Oil Products Co., has recently given a lucid short survey as to how this fuel situation was handled. From this survey it may be gathered that liquid fuel, manufactured from the low-grade Swedish shales, played an important role during the war.

As the United States possesses considerable resources of shales, which, furthermore, to a large extent are of higher grade than the Swedish ones, and as it is not improbable that in a not-too-distant future these resources will have to be used when the natural oil resources decrease, it may be of some interest to learn how, in Sweden, the problem of producing oil has been successfully solved technically and economically by using low-grade materials.

*Mining engineer.

This article deals only with one of the methods now used in Sweden to produce oil from shale. According to this method, based on the effect of units of small retorts using heat from flameless (surface) combustion of the shale coke, the liquid fuels are manufactured at considerably lower prices than is possible with the three other methods also in commercial use in Sweden.

This method, invented by the author in 1919 and later improved, involves a low-temperature distillation. The shale, crushed to a suitable small grain size, is retorted with the addition of steam in a large number of small retorts, grouped into a furnace unit or block, which is heat-controlled and working continuously. The dimensions and arrangements of the retorts are shown in Fig. 1.

The hot coke residue from the distillation is burned as fuel, furnishing thereby the heat necessary to carry out the distillation and to produce also considerable quantities of surplus heat, which is converted into steam and power. The diagram in Fig. 2 shows what is required to produce 1 bbl. of oil from shale and all the byproducts obtained at the same time.

The plant consists of a main part, the retorting and condensing plant, in which the distillation is carried through, and two auxiliary plants, the power-plant and the sulfur plant for utilizing the byproducts from the distillation plant. With regard to power and heat, the whole plant is self-supporting and, of special importance to Sweden, the oil and gas are produced without using any outside fuel. A necessity for all industry in Sweden is and must be economy and as effective utilization as possible of all kinds of fuel.

The shale and the limestone stratified therein, is mined in open cuts. The shale is blasted and then loaded by excavators, leaving the big lumps of limestone in the mine. The transport is carried out by means of locomotive and Decauville cars. The rock is then coarsely crushed, the lime-

(Continued on page 254)

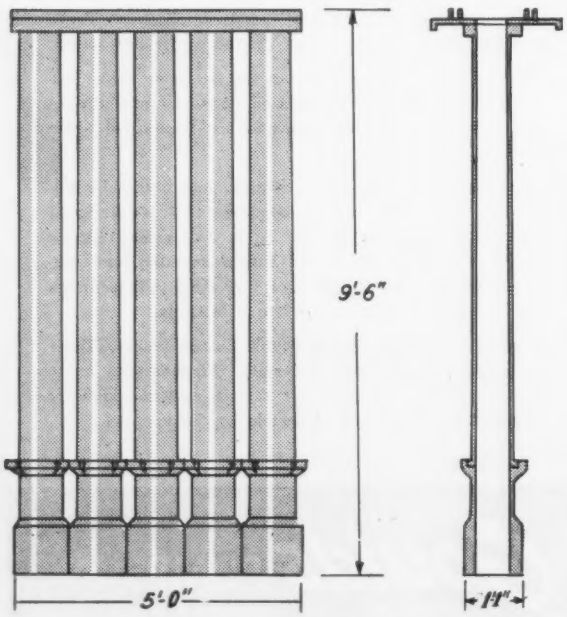

Fig. 1—Dimensions and arrangement of a unit of small retorts

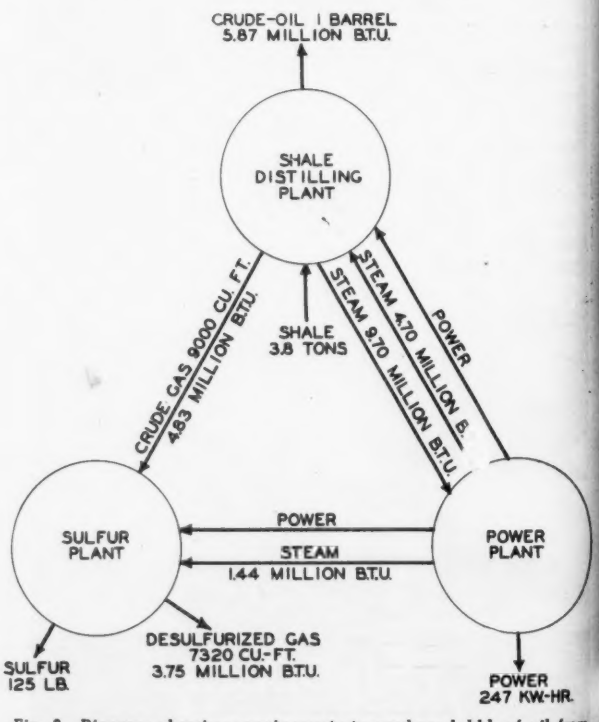

Fig. 2—Diagram showing requirements to produce 1 bbl. of oil from Swedish shale

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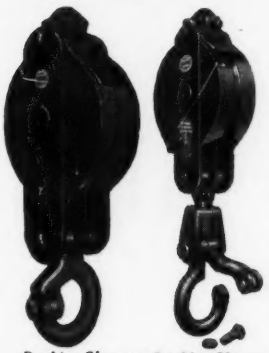

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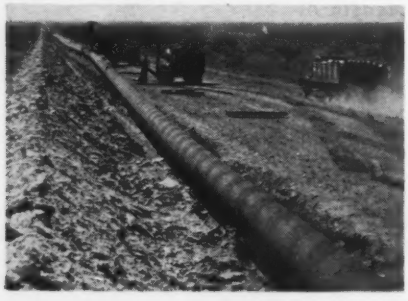

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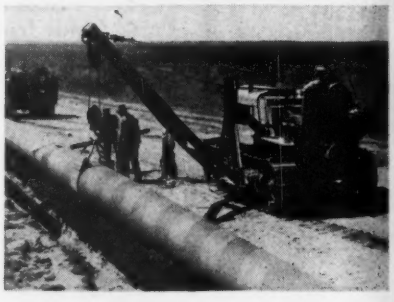

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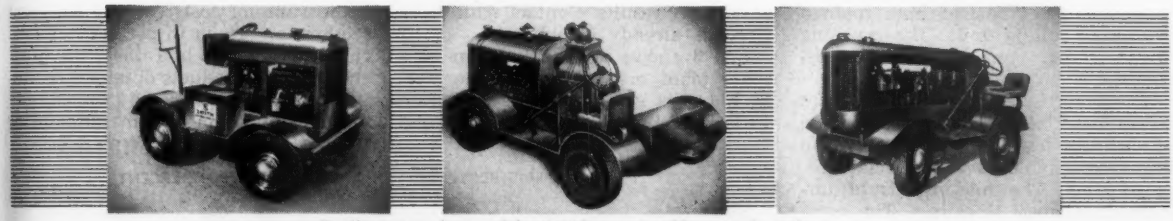

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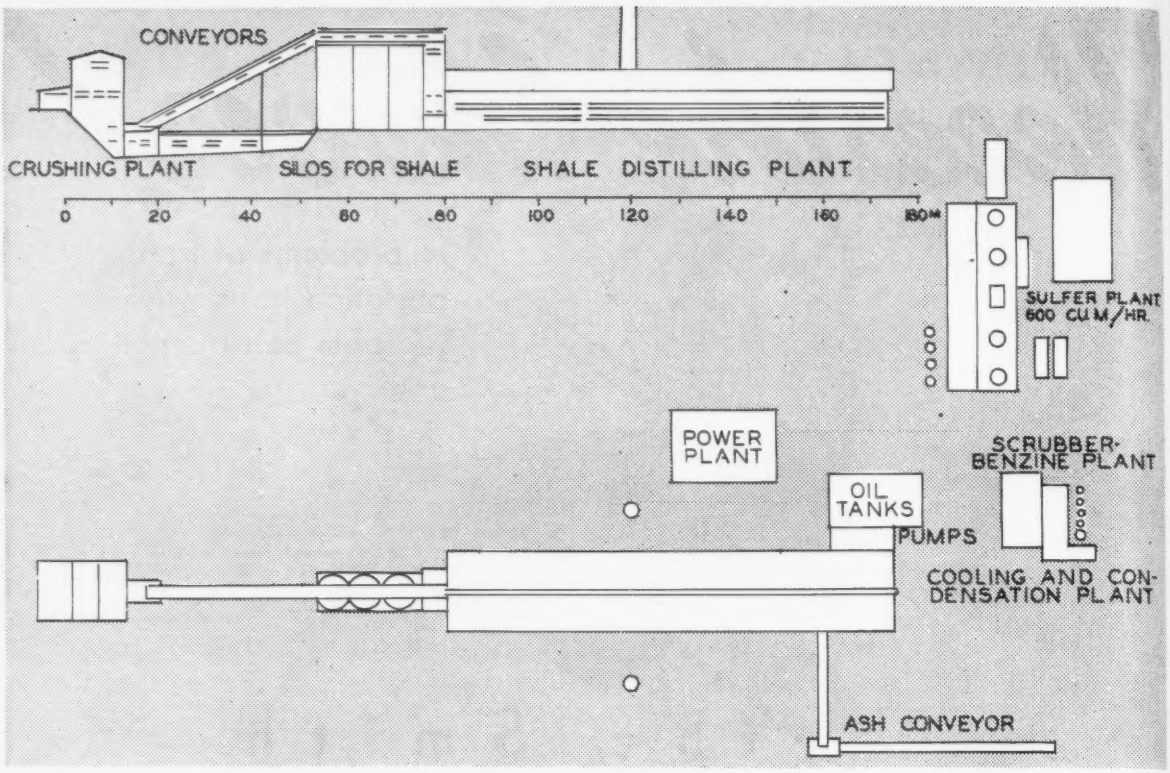

Fig. 3—Section and plan arrangements of shale-oil-manufacturing plant using the Bergh system

stone being picked out by hand, and the shale fine crushed in a toothed four-step rolling mill. By crushing about 15 per cent of smalls is obtained.

The retorting plant is built from cheap materials. The retorts are made of ordinary cast iron with only the lower detachable parts of special fireproof steel. The masonry is of uncommonly small thickness. The combustion chamber is of low-temperature refractories. The steam boilers consist of bundles of pipes placed by the retorts, and in the fireroom, and through these water is forced throughout the circuit. This not only renders the steam boilers highly effective with regard to steam generation, but also supplies a means of regulating the heat and temperature in the retorts and in the fire. The ashes, practically cool and wholly burned out, are discharged continuously by means of slowly and intermittently working discharge arrangements in the lower part of the furnaces.

The power plant consists of a collecting steam drum, pumps for circulating the feed water, and a back-pressure turbine.

The sulfur plant is of German design and consists of two parts, a washing plant for separating H_2S from the distilling gases, and a plant for producing elementary sulfur from H_2S. It is very probable that a plant, for instance from the American firm of Girdler Corp., Louisville, Ky., or Fluor Corp., Los Angeles, would give still better results. Contact with these firms is already established.

Fig. 3 shows an outline plan of a shale plant erected during the war. In Fig. 4 is given a Sankey diagram with heat balance of the shale distilling and condensing plant. In Table 1 the running costs for the different sections are given in per cent of total running cost, and in Table 2 the properties of the products obtained by distilling Swedish shale.

An estimate of the manufacturing

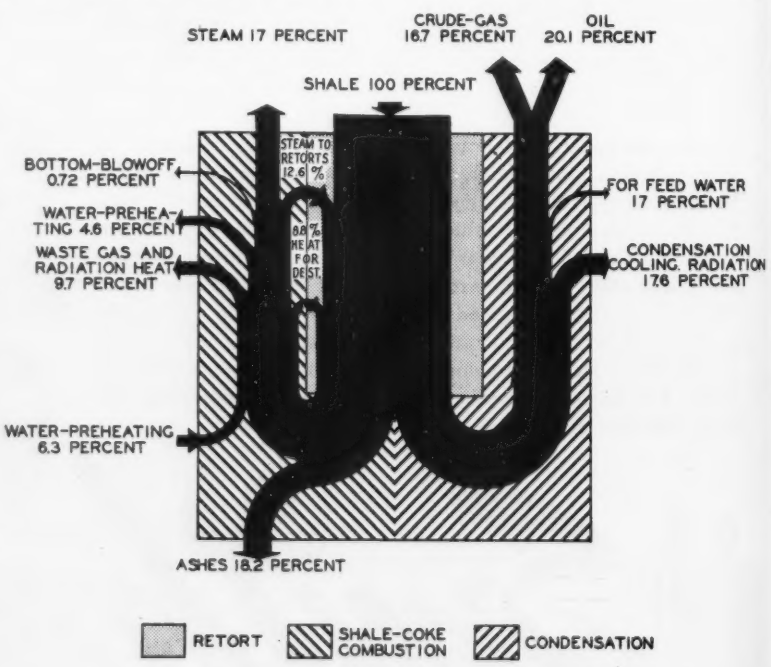

Fig. 4—Sankey diagram showing heat balance of shale-distilling plant

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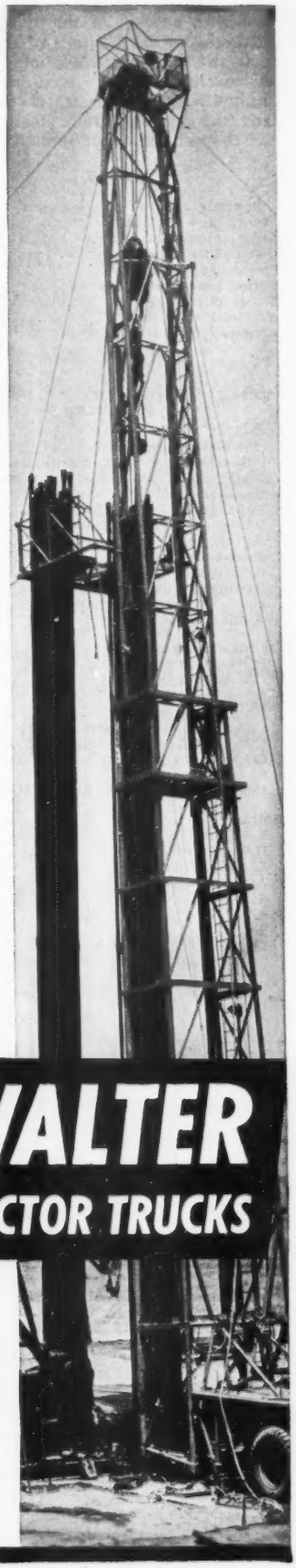

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cost with a plant of this description, disposing of 213,839 tons of shale per year and yielding 56,500 bbl. of crude oil (exclusive of the scrubber naphtha), 413,000,000 cu. ft. of desulfurized fuel gas, high-grade steam energy for the generation of some 14,000,000 kw.-hr. is found in Table 3, where the weight of sulfur, 3,200 tons a year, is also stated. The different products yielded, i.e., oil, gas, and high-grade steam energy, are supposed to be of the same rating with regard to heat value. Particulars of production data are given in Table 4. The following manufacturing costs as calculated on the 1938 and 1945 prices will then ensue:

	1945	1938
Crude oil (cents per gal.)	8.0	7.1
Desulfurized fuel gas (cents per cu. ft.)	0.029	0.026
Electric power (cents per kw.-hr.)	0.60	0.52

The manufacturing cost for the crude oil about equals the import price of 1938 in Sweden. To draw a parallel between the manufacturing cost for desulfurized gas and ordinary coal gas, it may be mentioned that before the war, the latter gas cost about 0.039 cent per cubic foot as produced in a gas works of a middle-sized Swedish town. Power cost is very low due to the power being generated with steam. Naturally the steam energy may be turned to other uses if more profitable ones can be found.

TABLE 1

Running costs—	Per cent of total cost
Mining and crushing	39.0
Running costs of furnaces	21.0
Conveyance of ashes	3.0
Power generation	4.5
Sulfur production	11.0
Stores purchases	9.0
Administration costs	8.0
Concession, insurance, taxes	4.5
Total	100.0

TABLE 2—PROPERTIES OF PRODUCTS PRODUCED

Crude oil:	
(Fuel oil, topped, report 33507 from Swedish fleet port, Karlskrona)	
Flash point (Pensky-Martens), °F.	168.5
Spec. grav., 68° F., lb. per gal.	8.058
Spec. grav. 104° F., lb. per gal.	7.944
Water (xylol distillation), per cent	0.7
Sulfur,* per cent	1.1
Heat value gross, B.t.u. per gal.	147,500
Heat value net, B.t.u. per gal.	139,600
Hydrogen, per cent	10.0
Hard asphalt, per cent	0.3
Aniline point, °F.	23
Desulfurized gas:	
H_2, volume per cent	21.8
CO, volume per cent	2.0
O_2, volume per cent	0.1
N_2, volume per cent	39.2
C_nH_{2n}, volume per cent	5.3
C_nH_{2n+2}, volume per cent	27.1
CO_2, volume per cent	4.5
S, grain per cu. ft.	1.18-1.53
Heat value net, B.t.u. per cu. ft.	511
Sulfur:	
S, per cent	99.93
H_2O, per cent	0.035
Fe_2O_3, per cent	0.016
Ashes, per cent	0.0206
Acid	None
AS	None
Se	None
Bitumen and ashes, per cent	0.0252
Insoluble in sodium sulfide, per cent	0.0168
Insoluble in carbon disulfide, per cent	0.062
Color	Pure yellow

*Sulfur in average, 1.5 per cent.

TABLE 3

Production:	Million B.t.u. year
Oil	332,000
Gas desulfurized	211,000
High-grade steam energy	145,000
	688,000
Production costs—1945 prices:	$ per year
Running cost	370,000
Cancelings:	
20 years, 5 per cent*	179,000
15 years, 5 per cent	17,600
	566,600
To be deducted, profit from sulfur:	
3,200 × $53.10	170,000
	396,600
1938 prices:	
Running cost†	296,000
Cancelings:	
20 years, 5 per cent	137,000
15 years, 5 per cent	13,500
	446,500
To be deducted, profit from sulfur:	
3,200 × $30.70	98,600
	347,900

Cost of production per million B.t.u.:

1945 prices $\frac{396{,}600 \times 100}{688{,}000} = 57.70$ cents

1938 prices $\frac{347{,}900 \times 100}{688{,}000} = 50.50$ cents

*As per experiences from the experimental plant (1926-1945). †Since 1938 prices are considered to have risen by 25 per cent.

Conclusion

Based on available data of erection and running cost for a shale plant to Bergh system, it has been shown that oil can be extracted from shales found in deposits in central Sweden, at a cost but slightly exceeding the prewar import prices. As the price also of the sulfur-refined high-grade gas is low, the fuels extracted from our richest shales (Fischer assay average 6 per cent of oil yield) ought to have competitive power as against imported fuels. This is bound to be of highest interest to industries located at such a distance from deposits that economic transport of the fuel (oil and gas) is possible.

In the estimates nothing but the thermal contents of the finished products, excepting the sulfur, has been considered. This by no means excludes the possibility of refining the oil and gas into products of higher quality instead of using them for fuel. Moreover, the production may be extended by turning byproducts of different kinds (as from ashes and limestone) to profitable uses.

It has been shown above that even though not taking into account those refined products and byproducts it is possible to work the shale at a profit, given a modern plant of the Bergh design.

For new plants the erection cost may be appreciably curtailed and the manufacturing cost for different products thus still more reduced.

TABLE 4—MONTHLY PRODUCTION OF A BERGH PLANT IN SWEDEN

1944—	Shale (tons)	Oil (bbl.)	Gasbenzin (bbl.)	Total yield per cent by weight of shale	Yield per cent by weight of Fischer assay*	Yield, per cent of Fischer	Gas, cu. ft. per ton of shale
July	20,983	4,470	932	3.80	5.38	70.6	2,010
August	20,038	4,420	1,080	4.02	5.54	72.6	2,150
September	18,542	4,540	962	4.37	5.35	81.7	2,190
October	17,975	5,330	992	5.21	6.07	85.8	2,330
November	16,900	4,660	771	4.78	6.10	78.5	2,400
December	18,787	4,520	767	4.17	5.50	76.0	2,240
1945—							
January	18,739	5,190	945	4.86	6.22	78.1	2,380
February	14,189	*3,830	752	4.77	6.18	77.2	2,770
March	17,588	5,160	871	5.10	6.04	84.4	2,580
April	16,212	4,600	826	4.96	5.28	93.9	2,660
May	17,150	4,930	760	4.94	5.76	85.8	2,620
June	16,736	4,950	835	5.14	5.82	88.3	2,540
July	17,833	4,710	778	4.57	5.30	86.2	2,360
August	16,980	4,650	892	4.83	5.56	86.8	2,400
September	15,775	4,800	548	5.09	5.84	87.2	2,470
October	16,980	4,650	892	4.83	5.56	86.8	2,400
November	17,000	4,870	877	5.01	5.35	93.6	2,400
December	16,879	5,190	877	5.34	5.80	92.1	2,390

*Assaying oil shale for oil yield according to Fr. Fischer is carried out in a retort of aluminum of a special construction and without steam. See Brennstoffchemie I. 35 (1920).

Colombia Creates New National Oil Council

BOGOTA.—First oil bill passed by the Colombian Congress was made into law last week, creating a 5-member national petroleum council. It is expected the council will act as an advisory body to the government on oil matters and lay plans for sound technical development of Colombia's oil industry in the future.

Under the bill as approved by Congress, the government will appoint two members to the council, the specialist in oil management and a second member at its discretion; the Senate will elect a specialist in oil legislation; the House, the petroleum engineer; and the Council of State, the economist.

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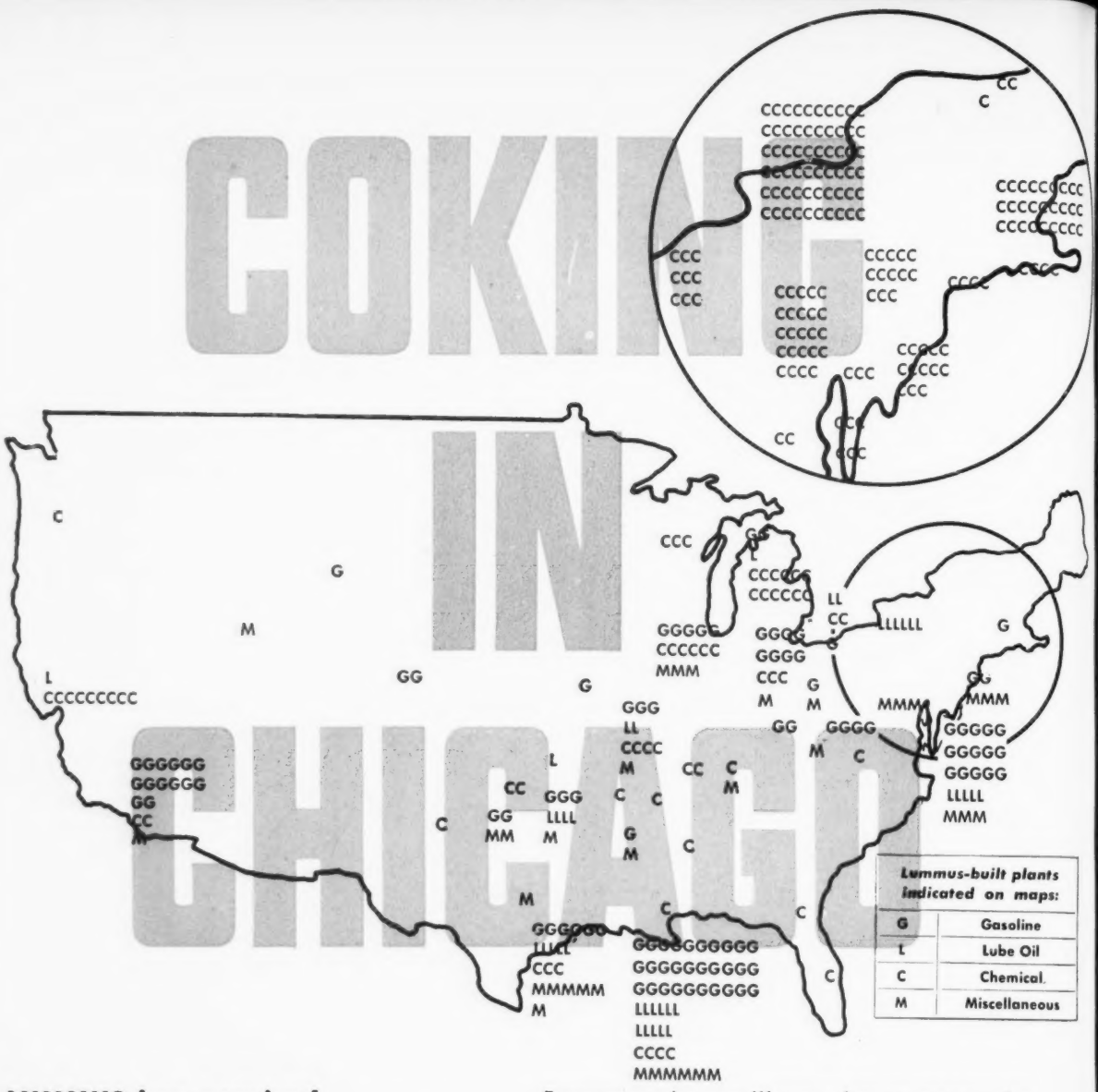

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French Geologists Look to Southwestern Region in Search for More Oil

by Jacques Asty*

IF France has long been preoccupied with assuring her supply of petroleum products, it is only very recently, since 1930, that she has seriously considered the possible existence of crude petroleum in the substrata of her own territories.

Before that date, one found only the enterprises of Pechelbronn, in Alsace, whose production for some time had been very low (70,000 tons per year*), and some prospecting, in Languedoc (Gabian) and in North Africa.

Since 1930, the government has actively participated in well-organized searches in North Africa and in Gabon, but still with insufficient means.

In 1937, a department of petroleum research was created whose aim is prospecting in continental France. The geologists looked immediately toward the southwest of France where two tests were started in 1938 and 1939. In July 1939, the Centre de Recherches de Petrole du Midi, now known as Regie Autonome des Petroles, discovered in Aquitaine natural gas at St. Marcet, 75 km. (46½ miles) southwest of Toulouse. In April 1940, the same tests deepened, produced crude petroleum.

Unfortunately, France was at war; some weeks thereafter, her territory was invaded and the Germans occupied it; there was no longer a question of bringing to life the petroleum which might exist in the substrata and which would serve to supply enemy armies. On the other hand, drilling equipment was sorely lacking, which offered a reason for limiting operations. Thus, during the entire occupation, and despite strong pressure from the Germans, we worked above all to prepare for the future, particularly by systematic geological study of all the Aquitaine and that part of Languedoc which borders the Mediterranean. So, until 1944, we succeeded in postponing direct action by the Germans. Such resistance, halted at this point by the Germans who finally installed their equipment in the area of the Regie, cost the life of the president of this organization, Pierre Angot, who was arrested in June 1944 and died during deportation.

Meanwhile, government plans were being reorganized. All of the Aquitaine region was set aside and, in 1941, the Societe Nationale des Petroles D'Aquitaine was organized for prospecting the regions outside of the domain of the Regie Autonome des Petroles. In 1944, the Societe Nationale des Petroles du Languedoc Mediterranee was founded to prospect in the Languedoc around the Mediterranean. For these two companies, the government called on private capital to furnish about 45 per cent of the whole.

During all of this period, geological and geophysical research was being carried on to locate promising sites. The zone prospected is situated in the sedimentary lands at the foot of the Pyrenees (region of the "Petites Pyrenees") where there are, of course,

*Engineer. Bureau de Recherches de Petrole. *1 ton = 7 bbl.

An extensive oil field near St. Gaudens, 15 miles outside of Toulouse, was drilled for the first time in 1939 and yields important quantities of natural gas. A dozen new drillings were projected, and of these, seven have been completed, six for natural gas, and one for oil. Shown here are views of drilling operations in the field. (Photos courtesy French Press & Information Service)

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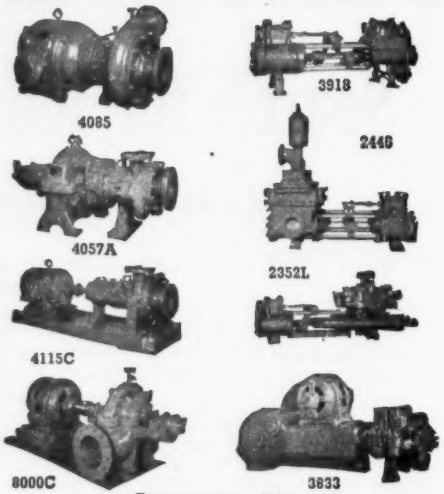

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The available equipment, about a dozen large rotaries, lacking spare parts and sometimes even fuel, was used as far as possible, especially on the anticlinal of St. Marcet, where gas had already been found, and where there was also a possibility of finding petroleum. All the specialized personnel at hand was used; the old teams of the Regie Autonome du Petrole, French engineers expelled from Romania, personnel of the Societe Cherifienne des Petroles, who sacrificed a large number of their best technicians in favor of the Fatherland. As to the equipment, it too came from many sources: Pechelbronn, Societe Cherifienne des Petroles, Regie, and many smaller enterprises.

The gas production reached 200,000 cu. m. (7,063,000 cu. ft.) per day in 1944, really an enormous gain for France, so poor in fuel. But the petroleum did not reappear.

As mentioned, the Germans, furious at the passive resistance, obtained a permit from the Vichy Government in 1944 to make the tests themselves in the area of the Regie. However, they had no greater success, in spite of their urgent desire to get hold of the petroleum.

Technically, however, their intervention was beneficial to us; they completed three wells, making it unnecessary for us to do so, and above all, during the liberation of France, they abandoned the material to assemble three rotaries immediately and five ultimately. At the liberation, we found ourselves in possession of about 15 large rotaries, but this equipment is out of date. There were also a certain number of low-power machines and some geological drilling rigs which are in scarcely better condition.

Future Program

The war made apparent to all those responsible for French economic policy the necessity for serious petroleum research and the importance of a financial and technical effort to obtain conclusive results in this field. The government has therefore decided to make this effort.

Three principal tasks lie ahead:

1. To finance the work, as much by calling on private capital as by budget subsidy.
2. To obtain as quickly as possible the indispensable equipment for advancing the project.
3. To train the technical personnel necessary to handle the equipment.

In 1945, the government organized the Bureau de Recherche de Petrole, a sort of holding company of the state, to facilitate financing and assume responsibility for the prospecting policy in France and in the French Colonies, distributing state credits among the organizations making explorations, and controlling the use of capital. Realizing the importance of continuity in the success of this enterprise, the Parliament has approved a 5-year program, assuring the bureau of budget credits for this period. In all, 55 billion francs will be spent in 5 years by the state, not only in the southwest of France but also in North Africa (Algeria, Tunis, and Morocco), in Gabon, Madagascar and, eventually, in other parts of the French Union.

Equipping prospecting organizations with drilling equipment is, as we have explained, an urgent necessity. The available equipment, little better than that left at the time of the liberation, differs only by some additional parts supplied by the French industry or recovered from Germany. The rest consists of American equipment dating from before the war, and German equipment.

The organizations for petroleum prospecting have created a cooperative company, S. N. Marep, to do their purchasing. Marep centralizes and coordinates the orders, standardizes the equipment. and encourages its manufacture in France. Several important orders have been issued to American manufacturers. We are expecting the equipment to be in operation by 1947.

Training Personnel

There remains, finally, the training of technical personnel, engineers, master drillers, and skilled workmen on the one hand, and geologists and geophysicists on the other, necessary to insure the most efficient use of the modern equipment which will arrive. The Institut Francais du Petrole is recruiting students from engineering, technical, and professional schools to train in the special fields necessary. It has already established "drilling schools" where American drillers teach the young French workers. On the other hand, many engineers have been sent to the U.S.A. to exchange technical ideas with American drillers.

We are persuaded that this technical collaboration, as much on the plane of equipment production as of personnel training, will give very satisfactory results, and we are happy to thank here those American companies that have given and continue to give us the fruit of their technical experience, and of their progress since 1940.

We hope that the organization which we have just described will further successfully and rapidly the discovery of petroleum in the southwest of France. We shall give briefly some indications of their present state.

La Regie Autonome des Petrole, which has prospected an area of 500,000 acres, has drilled there 21 wells, the deepest over 3,000 m. (9,840 ft.), representing about 60,000 m. (186,800 ft.) in all. Seven other wells are being drilled. All these wells are concentrated on eight anticlinal structures. Two structures have produced gas—St. Marcet and St. Martory. A third (Plagne) has also given encouraging indications of the presence of gas. Finally, a well on the structure of St. Marcet promises to produce liquid hydrocarbons.

The present small gas production is limited by the lack of absorption plants and of pipe lines to distribute gas to the consumer. At present, the pipes extend about 200 km. (124 miles). They feed urban points of distribution and some factories and are used for motor fuel.

An important extension of the pipe line is being constructed which will permit the flow of 1,000,000 to 1,200,000 cu. m. (35,315,000 to 42,372,000 cu. ft.) per day, an amount compatible with the power attributed by the technicians to the output. At the same time, a modern installation capable of absorbing the entire production is being ordered in the United States.

This production may seem insignificant compared with that of America. We insist, however, upon its importance to French economy. Whether the gas is considered as a source of energy or as a natural resource for the chemical industry, it represents an important asset for France, so poor in power. On the other hand, the proceeds from the sale of gas are a considerable contribution toward the expense of research. Finally, let us not forget the moral factor; such a discovery may engender new energy in those who may have been doubtful of the success of the enterprise. We count also on finding again the petroleum that made its timid appearance in 1940.

The Societe Nationale des Petroles D'Aquitaine (S.N.P.A.), which explored an area of 5,000,000 acres, limited itself during the occupation to working the eastern portion of its region, the western part being situated in a zone occupied by the enemy. Its principal development is in the western sector.

Since 1941, date of its organization, S.N.P.A. has drilled three deep wells and a certain number of exploration rigs. Five deep excavations are now in progress. Six principal structures are being studied for deeper drilling, two situated in the eastern sector, four in the western. The defective state of equipment forced the abandonment of some wells before definite indications could be obtained. The presence of gas there had, however, been detected.

In addition, the company is realizing an important program of research, geological and geophysical, bringing in particular drillings on a score of visible and buried structures.

The geographic similarities between

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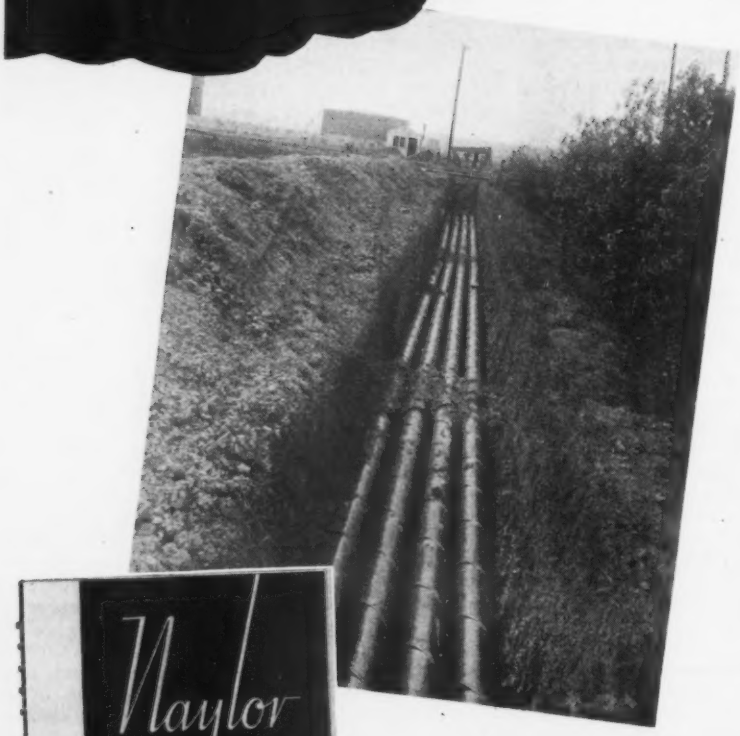

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the area of the S.N.P.A. and the Regie Autonome des Petroles, together with the known indications of the former, encourage us to believe that gas will be found there, and to hope also for the discovery of oil.

The Societe Nationale des Petroles du Languedoc Mediterranee (S.N.P.L.M.) has secured exclusive permission to search for hydrocarbons within a radius of about 1,600,000 acres. This company is the successor of a private company where Pechelbronn succeeded in sheltering Alsatian personnel and equipment during the occupation, and which had been interested in this section offering many well-known promises—in particular the little jet in Gabion, discovered by the state in 1924.

Important geological and geophysical work has been accomplished in this region since 1941. It has strengthened interest in the region and helped fix a score of locations favorable to the accumulation of petroleum. Three deep drillings are actually being made on the three locations which seem most promising.

Let us note that S.N.P.L.M., youngest organization of the southwest, is only beginning its work but it has the same chance of success as the other companies.

After this rapid bird's-eye view, let us come to some conclusions. We can only say that we have solid hopes of achieving satisfactory results, and of achieving them quickly.

The entire financial support given in 1946 will amount to about a billion francs for the research made in the southwest of France alone. It is, perhaps, still too little—of that we are very conscious. We cannot ignore the fact, however, that the problems ahead are particularly difficult because of the depth of the rock formations in this entire area. In this fact lies a reason for France's lag in the field. We are still only beginning.

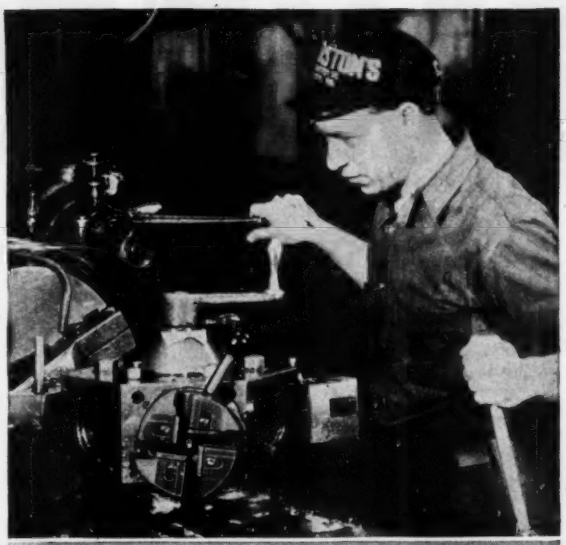
Argentina to Receive Oil From Chile Under Pact

BUENOS AIRES. — An important trade pact under which Argentina will lend Chile approximately 300,000,000 pesos ($90,000,000) is reported pending here.

Authoritative sources say Chile will provide Argentina with petroleum, coal and other minerals under the agreement, receiving in return meat and other food products.

Canada Drops Gasoline Tax

OTTAWA, Ont. — The Canadian Government has announced that the dominion gasoline tax of 3 cents per imperial gallon, imposed as a war measure, will be discontinued April 1. This action will leave the field of gasoline taxation entirely to the provincial governments.



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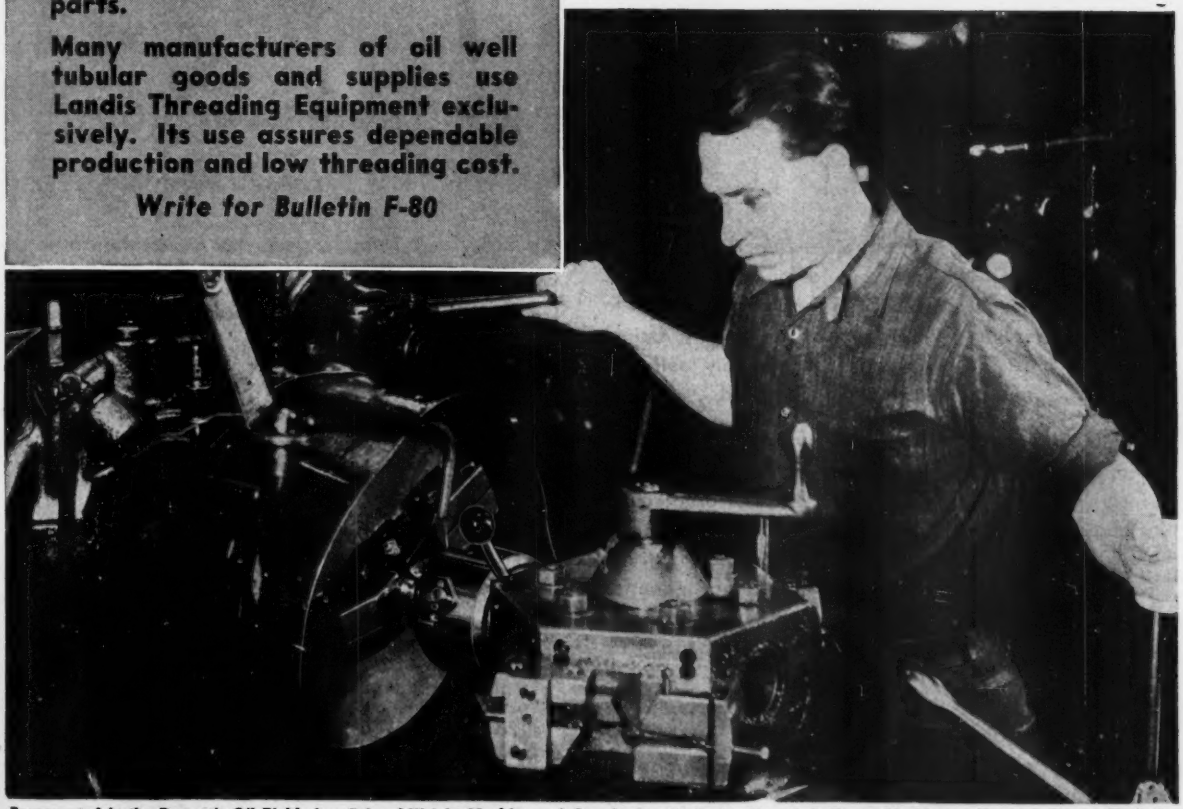

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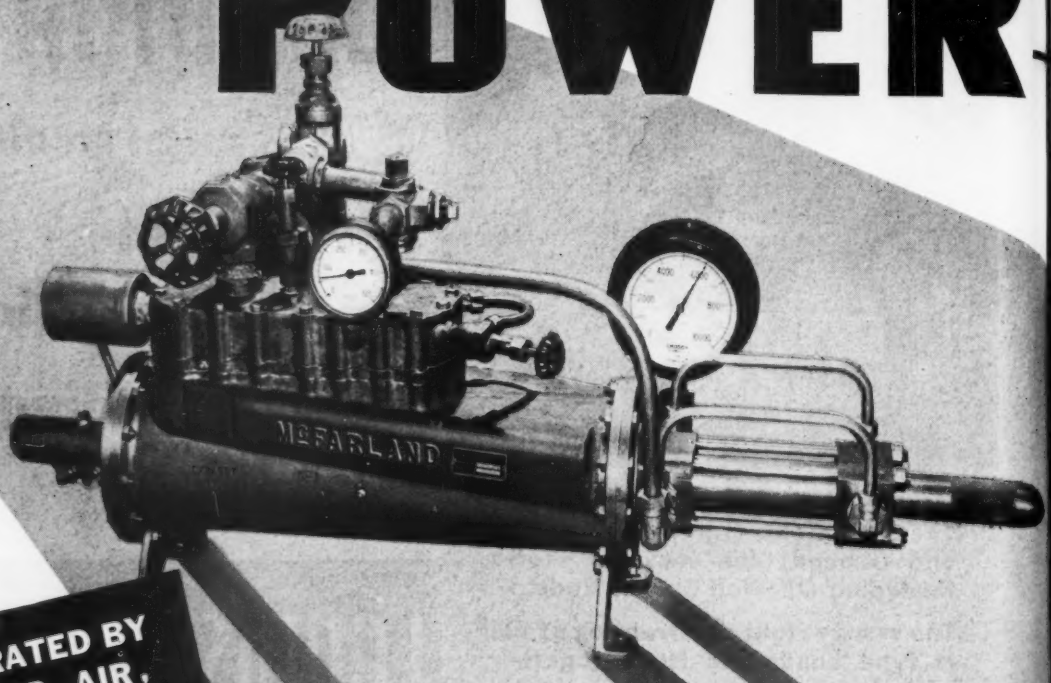

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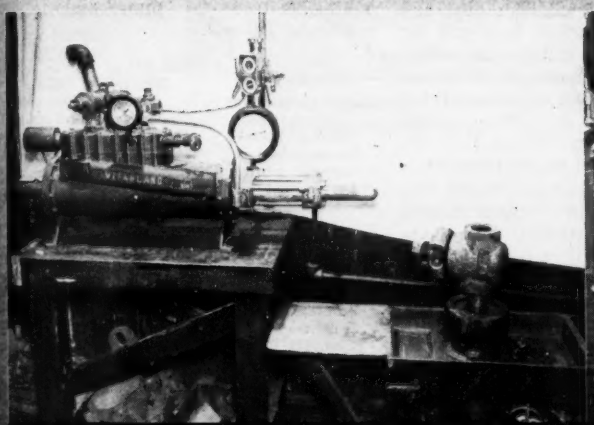
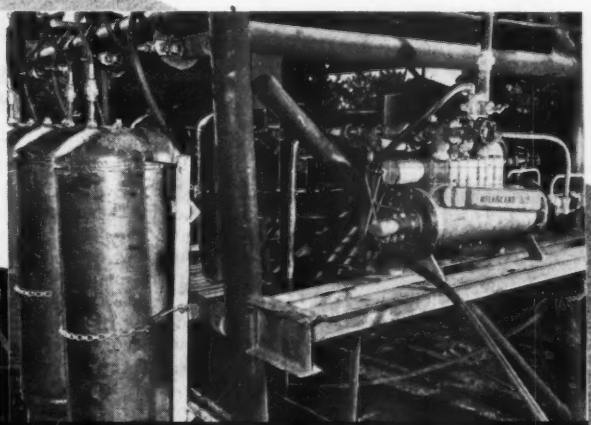
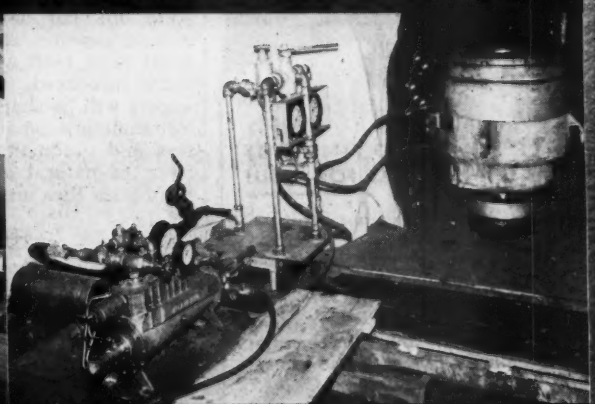


Testing repaired, high pressure plug valves. Operated by air at 125 p.s.i., this McFarland Unit is called upon to furnish pressures as high as 20,000 p.s.i.



Testing high pressure steel tanks. This McFarland Unit, operated by water pressure, provides hydrostatic pressure of 600 p.s.i.

One McFarland Unit, operated by 125 lb. steam pressure, operates this bank of hydraulic presses. Presses are used in molding synthetic and rubber goods.



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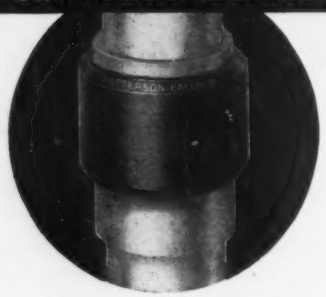

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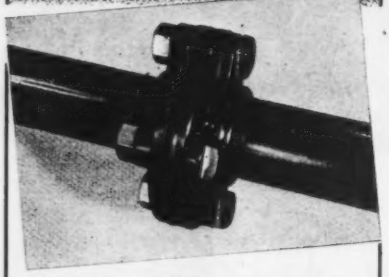

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Petroleos Mexicanos

(Continued from page 235)

The Ciudad Madero and Arbol Grande refineries are expected to refine the amounts of various crudes during the next 4 years that are shown in Table 2.

TABLE 2
(Barrels per day)

Year—	1947	1948	1949	1950
Poza Rica crude	36,000	47,000	50,000	53,000
Naranjos crude	20,000	18,000	16,000	16,000
Panuco crude	9,000	11,000	11,000	13,000
Total	65,000	76,000	77,000	82,000

These two plants now use electric energy from Tampico Electric Co. A new thermoelectric plant is planned for the Ciudad Madero refinery to supply both plants with current. A 15,000-bbl.-per-day cracking unit also is planned for Ciudad Madero, and a lubricating-oil unit for Arbol Grande.

For the West Coast supply, products must be shipped by rail from the Minatitlan refinery to Salina Cruz on the coast. The maximum which can be shipped is 8,000 bbl. per day, and at very high cost. Plans now call for the construction of a pipe-line across the Isthmus of Tehuantepec to Salina Cruz and the building of a plant there of 20,000 bbl. per day which could later be doubled in size to care for future demands and crude supplies.

Poza Rica now produces 75,000 bbl. per day of crude and about 80 million cubic feet of gas. A new plan is in progress which will process all gas at 300 psig. (65 per cent is produced now at 400 psig. and 35 per cent at 60 psig.). The gas will be freed of hydrogen sulfide by the Girbotol process. Isobutane, butane, isopentane, the isomers for aviation fuel will be recovered. Later a gas line to Mexico City will be built, to use the stripped gas as fuel. Into the crude going to the Atzcapotzalco refinery will go 3,250 bbl. per day of depropanized natural gasoline. The crude-stabilizing plant to be built will stabilize all the crude produced, and the overhead vapors will be stripped of butane and isobutane in a separate unit. Composition and production, in mol. lb. per hour, of natural gasoline and crude from Poza Rica are shown in Table 3.

TABLE 3

Mol. lb./hr.	Gasoline	Unstabilized crude	Crude for Atzcapotzalco	Crude for Tampico
H_2S	.....	38.8	.....	1.6
CH_4	.....	5.9	.....	.....
C_2H_6	.....	6.3	.....	0.2
C_3H_8	3.8	60.9	3.8	5.1
i-C_4H_{10}	49.0	22.0	49.2	4.1
n-C_4H_{10}	206.0	112.2	209.3	26.3
i-C_5H_{12}	67.0	54.4	74.8	23.2
n-C_5H_{12}	87.6	93.2	105.7	44.2
C_6H_{14}	92.3	316.7	206.2	173.5
Heavier		3,812.2	2,028.5	1,777.9
Total	505.7	4,522.6	2,677.5	2,056.1
Bbl./day	3,820.0	76,910.0	43,500.0	35,300.0

The data shown in the preceding tables show that important quantities of normal and isobutane, and isopentane are recovered. A desalting unit is to be installed to water wash and treat chemically the high-salt crude, in which salt content will be reduced to 9 lb. per 1,000 bbl.

The Poza Rica-Atzcapotzalco pipe line includes 35.5 km. (22.1 miles) of 12-in. (a portion at each end of the line), and about 200 km. (125 miles) of 10-in. in between. Six pump stations, each with three duplex pumps driven by motors and 7,500 bbl. per day capacity, send 22,500 bbl. per day through the line to the Atzcapotzalco plant. The capacity will be raised to 37,300 bbl. per day by addition of three more pump stations.

A 23,500-bbl.-per-day topping plant was added to the Atzcapotzalco plant, a 13,000-bbl.-per-day Dubbs cracking unit, a butane isomerization plant for 300 bbl. of product per day, an 813-bbl.-per-day alkylation plant (HF), three steam boilers of 120,000 lb. per hour capacity, two 5,000-km. turbo-generators, and a water-cooling tower. Production of various commercial materials from this plant will be as shown in Table 4.

TABLE 4

	Bbl. per day of operation	Bbl. per calendar day
Motor gasoline (60 to 70 octane):		
Normal butane	857	.....
Isopentane	94	.....
Normal pentane	1,169	.....
Direct gasoline depentanized	8,207	.....
Cracking gasoline	4,695	.....
Heavy alkylate	17	.....
	15,039	12,783
Aviation gasoline (100 octane):		
Isopentane	317	.....
Hexanes	94	.....
Alkylate	813	.....
	1,224	1,040
Gas Pemex	820	697
Kerosene	5,970	3,075
Diesel oil	1,185	1,007
Fuel:		
Badger Braun residue	475	.....
New topping plant residue	11,130	.....
Dubbs plant residue	6,850	.....
	18,455	15,687

A Perco copper-treating unit for sweetening gasoline with $CuCl_2$ is installed in this plant, treating the iso and normal butane and isopentane, the hexane fractions, and the topping-plant gasoline. Cracked gasoline is doctor sweetened, as will be kerosene, and plans for a sulfuric acid kerosene-treating unit are made. An Edeleanu sulfur dioxide treating unit may be installed.

The Poza Rica-Atzcapotzalco line can be boosted to 50,000 bbl. per day by minor changes, and to 80,000 bbl. per day by adding another pump station and replacing the main line with 12-in. pipe instead of 10-in.

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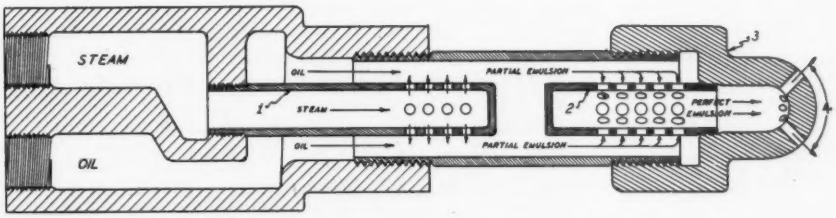

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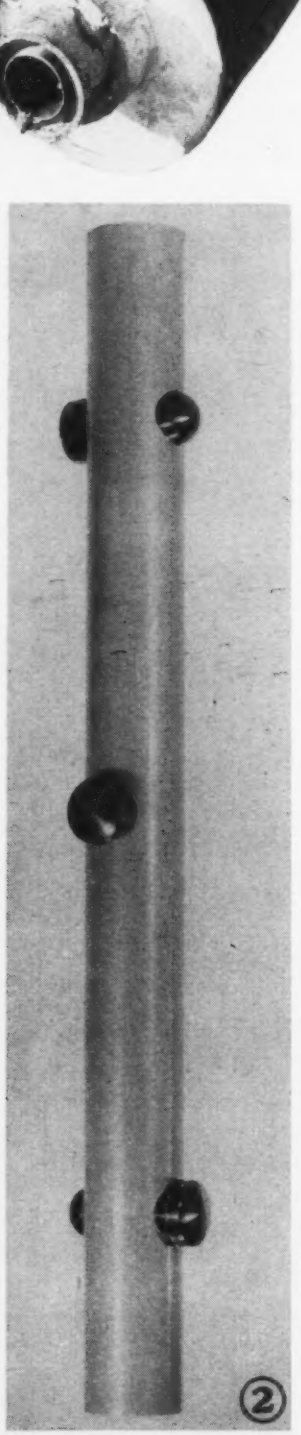
Casing Perforating With *Shaped* EXPLOSIVE CHARGES

by R. H. McLemore*



THE wartime role of "shaped" charges is now well known—particularly that of the tank-piercing warhead of the "bazooka rocket," which proved so effective in the Battle of North Africa. The principle of shaped explosive charges consists of leaving a cavity, or air space, in the explosive at the spot where the maximum force is desired. This principle is of interest to and now has been applied in a practical way to completion work, where greater depth of penetration in the perforating of oil-well casings has long posed a complex problem to production engineers. Recent investigations reveal some limitations to gun perforating and data relative to perforating the desired amount of casing and its surrounding cement sheath.[1]

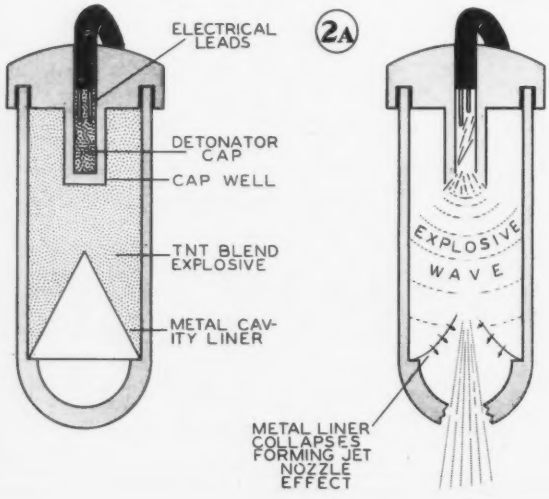
The test results to be presented are the culmination of intensive research and development during the past few years in the field of shaped high-explosive charges.† These results, together with others obtained from several field tests during recent months, were obtained with the cooperation of various members of the oil industry. Satisfactory depths of penetration through casing, cement, and into formation can be secured with minute quantities of certain explosives when utilized in these newly developed shaped charges. This depth of penetration can be obtained with no detrimental effect on the pipe or cement.

*Well Explosives, Inc., Fort Worth.
†Patented and patents pending.

Details of Shaped Explosives

In the casing-perforating charges, the explosive is placed in a plastic container, leaving a cavity in one end. An air space is formed by the nose end of the container and the interior of a conical metal cavity liner, against which the explosive rests. The diameter, angle, thickness, and material of the liner all have a bearing on the size of the hole formed by the detonation, and on the total depth of penetration. In the tests to be described, the average diameter of the entrance hole for the normal charge was ½ in.; for the heavy charge ⅝ in.

The hole is made by an extremely high-velocity metallic jet caused by the detonation of the explosive. This



The three figures on this page are the highlight illustrations of this article, which is concerned with a new method of oil-well perforating and shooting. Fig. 2A shows the explosive charge in its plastic container and the explosive principle. Fig. 2 is a photograph of three of the charges in the plastic cylinder which is run into well. Fig. 1 is one of the test units of casing and cement on which the explosive effects were determined

jet is emitted from the conical liner as it is progressively collapsed by the detonation wave of the explosive. Following behind the jet is the collapsed cone, referred to as the "carrot."

Determining Explosive Effects

A series of surface tests has been completed recently in which various sizes of casing were cemented in steel oil drums (Fig. 1) to simulate casing conditions within the well bore. In Table 1 are descriptions of the seven test units which were made.

In executing the tests, two sizes of casing perforating charges were used: the normal casing-perforating charge, designed to give deep penetration under normal conditions; and the heavy duty charge, containing 2½ times the amount of explosive in the normal charge, and designed to be used under particularly difficult conditions. Both the normal and heavy duty charge were in the same size container. Both sizes of charges were fired in all test units. For the purpose of determining the possible trouble to be encountered by the lodging of the carrots in the perforations, the charges were further varied by the use of hard-metal cavity liners in some charges and soft-metal liners in others. A typical multiple arrangement (three shown) of shaped charges is depicted in Fig. 2.

In Table 2 are listed the depths of penetration secured with both the normal and heavy duty charges, utilizing both the hard and soft-metal liners.

The results indicate a better uniformity and possibly somewhat greater penetration when hard-metal liners are used. However, this is believed to be due to the difference in manufacture of the two types of liners, the hard liners used in these tests being of much more uniform construction and wall thickness than the soft liners.

It was found that the soft-metal liners, with only one exception, disintegrated completely while going through the cement, concrete, or sand. Due to this disintegration the perforations were clean and open, and there was no problem of perforation plugging by the carrots. The carrots from the hard-metal liners were found to lodge in the ground outside the drum. The hard-metal carrots did not disintegrate completely while going through the concrete or sand.

The test units were cut open and the concrete, cement, and casing carefully examined to determine the effect of the shaped charge. In Fig. 3 is shown the hole made through the concrete by a normal charge, after penetrating the casing and neat cement. In Fig. 4 is shown the hole made through the concrete by a heavy duty charge. The heavy duty charge bulged 5½-in. pipe approximately ⅛ in. on the diameter, but had no tendency to split or bulge 7-in. pipe. The normal charges caused no bulging or splitting of the pipe in any of the units. As an example of the bulging or splitting to be expected under extreme conditions, an open-hole charge, not designed for use in casing and containing eight times the amount of explosive in the normal charge, was fired into one of the test units. Fig. 5 indicates the splitting and bulging as a result of the firing of this charge, which of course would be considered incidental to the extreme depth of penetration desired.

Due to its extremely high velocity, the metallic jet penetrates through the casing and the surrounding neat

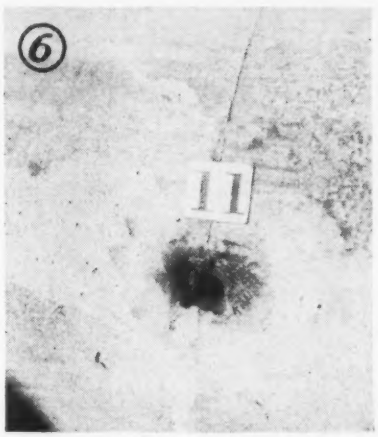
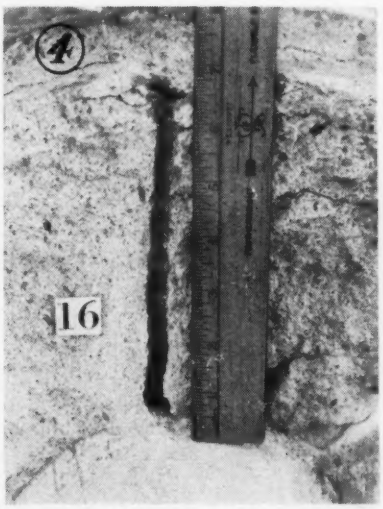
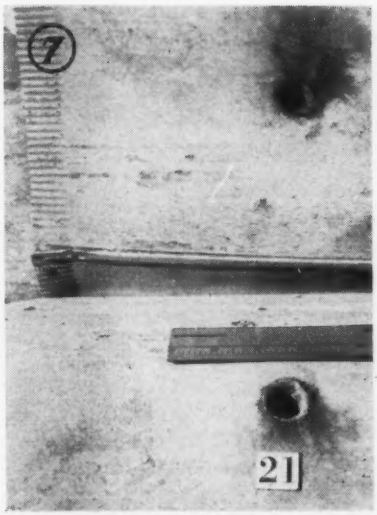


Fig. 3—Lateral hole through concrete after penetrating casing and 1-in. neat cement. Normal charge Test unit No. 1. Fig. 4—Lateral hole through concrete after penetrating casing and 1½-in. neat cement. Heavy-duty charge. Test unit No. 5. Fig. 5—Bulging and splitting of the casing from the "open hole" charge, containing eight times the explosive of the normal charge. No visible damage was done to the casing by the normal charge. Fig. 6—Exit hole from neat cement caused by heavy-duty charge. Test unit No. 1. Fig. 7—Exit hole from neat cement caused by open-hole charge





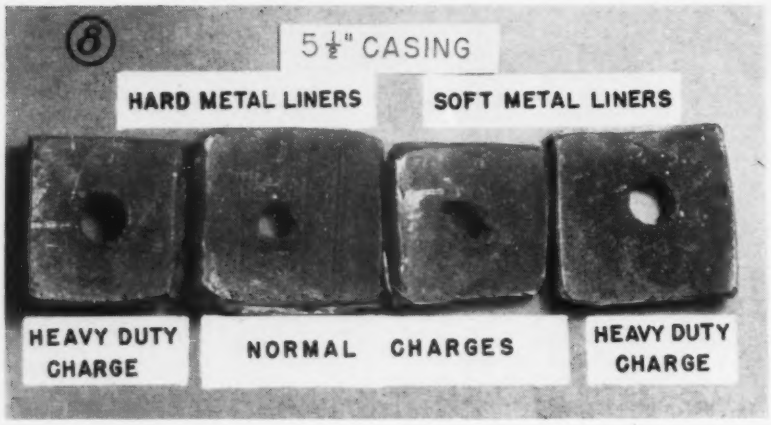


Fig. 8—Entrance holes into inner strings of casing from normal and heavy-duty charges

cement with no apparent fracturing. In Fig. 6 is shown the clean ⅝-in. hole through the neat cement made by a heavy duty charge. Again, as an extreme example, the exit hole from the neat cement caused by the big open-hole charge is shown in Fig. 7. There is no evidence of fracturing, though the hole through the neat cement from this heavy open-hole charge is approximately 1 in. in diameter.

In an effort to illustrate the burr characteristics to be expected from shaped explosive charges, the entrance holes into the pipe made by the firing of the various charges are shown in Fig. 8. Most of the charges leave some burr on the inside of the pipe, though in no case does this burr protrude more than ⅛ in. into the pipe.

Test unit No. 7 (see Table 1), was a pressure-test device consisting of 5½, 7, and 9⅝-in. casing cemented together, with provision made for sealing the 5½-in. pipe. The charges were placed in the 5½-in. casing, which was then filed with oil and pressured to 1,200 psi. Three charges were initiated simultaneously, two of these being heavy duty charges and one normal charge. The normal charge and one of the heavy duty charges penetrated all three strings of casing. The container of the other heavy duty charge apparently leaked, as a low-order detonation was secured, with poor penetration. Though the firing of the charges blew off the sealed ends of the 5½-in. casing, there was no splitting of the 5½ or the 7-in. casing. There was a slight bulge in the 5½-in. casing at the spot where the heavy duty charge penetrated, and a slighter bulge in the 7-in. casing, but no bulging at the normal charge position, or at the defective heavy duty charge position. The outer string of 9⅝-in. casing, not being backed up, split for a distance of approximately 2 ft.

In connection with the above tests, a short series of open-hole charges were fired. One of these was fired into a hard sandstone outcrop, through a ½-in. steel plate to preserve the face of the sand. After penetration of the ½-in. steel plate, a hole was made 14½ in. back into the sandstone. In Fig. 9 is shown the entrance hole, with the fractures created outlined in heavy pencil.

Another charge was fired into an extremely hard limestone outcrop. Shown in Fig. 10 is the entrance hole into the formation made by the charge which penetrated a distance of 7¼ in., with the resulting fractures outlined. The soft-metal carrot was lodged alongside the limestone hole, 2¾ in. from the face of the outcrop. The soft-metal carrot from the shot in the sandstone formation completely disintegrated. A third open hole charge was fired into test unit No. 6, as an extreme example of splitting, bulging, fracturing, and penetration to be expected from shaped explosive charges. The splitting and bulging are shown in Fig. 5. The exit hole from the neat cement is shown in Fig. 7. The path through 4⅛-in. of concrete is shown in Fig. 11. In addition to penetrating the test unit, the jet went through a ½-in. steel plate which was placed below the test unit, and 14 in. into the ground.

The above-described tests, while made on the surface under simulated conditions, indicate the degree of penetration and effect that can be secured from the shaped charge method of casing perforation. It is evident that this can be done with no detrimental effect on the casing, without causing an excessive burr, and with no damage to the casing or neat cement. The process has the additional advantage of offering to the oil operator a means of getting any desired greater depth of penetration at the expense of correspondingly great-

Fig. 9—Entrance hole into sandstone outcrop from open-hole charge. Fractures are outlined in heavy pencil. The hole is 14½ in. deep.
Fig. 10—Entrance hole into limestone outcrop from open-hole charge. Fractures are outlined in heavy pencil. The hole is 7¼ in. deep.
Fig. 11—Lateral hole through concrete after penetrating two strings of casing and 3 in. of neat cement. Open-hole charge. Test unit No. 6

TABLE 1—DESCRIPTION OF TEST UNITS FOR EXPLOSIVE EFFECTS

Test Unit No. 1—7-in. 28 lb. N-80 casing in 9-in. sheet-metal form with neat cement in the annular space between the casing and the form, and concrete in the space between the sheet-metal form and the 22-in. diameter oil drum.

Test Unit No. 2—5½-in. 17-lb. J-55 casing in 8-in. sheet-metal form with neat cement in the annular space, and river sand in the space between the sheet-metal form and the 22-in. diameter oil drum.

Test Unit No. 3—5½-in. 17-lb. J-55 casing in 8-in. sheet-metal form with neat cement in the annular space, and concrete in the annular space between the sheet-metal form and the oil drum.

Test Unit No. 4—7-in. 28-lb. N-80 casing in a 9-in. sheet-metal form with neat cement in the annular space, and river sand in the annular space between the sheet-metal form and the oil drum.

Test Unit No. 5—5½-in. 17-lb. J-55 casing inside 8⅝-in. 40-lb. N-80 casing inside an 11-in. sheet-metal form with neat cement in the annular spaces between the casing and the sheet-metal form, and concrete in the annular space between the sheet-metal form and the oil drum.

Test Unit No. 6—7-in. 28-lb. N-80 casing inside 10¾-in. 40.5-lb. N-80 casing inside a 12¾-in. sheet-metal form, with neat cement in the annular spaces between the casing and the sheet-metal form, and concrete in the annular space between the sheet-metal form and the oil drum.

Test Unit No. 7—A pressure unit, consisting of 5½-in., 17-lb. J-55 casing inside 7-in. 28-lb. N-80 casing, inside 9⅝-in. 55-lb. N-80 casing, with neat cement in the annular spaces. Provision was made to seal the 5½-in. casing so that it could be pumped up to 1,200 psi. pressure after the charges were placed inside.

Note: Neat cement in the above test units had been set up 29 days and had a tensile strength of 515 psi. Concrete in the above test units had been set up 33 days and had a tensile strength of 430 psi.

TABLE 2—MATERIALS PENETRATED AND DEPTHS

Charge No.	Test Unit No.	Type of explosive unit used
		Hard-Metal Liners—Normal Charge
1	1	7-in. 28-lb. N-80 casing; 1-in. neat cement; 4-in. concrete.
2	1	7-in. 28-lb. N-80 casing; 1-in. neat cement; 6.5-in. concrete.*
3	4	7-in. 28-lb. N-80 casing; 1-in. neat cement; 6.5-in. river sand.*
4	4	7-in. 28-lb. N-80 casing; 1-in. neat cement; indeterminant depth in river sand.†
5	5	5½-in. 17-lb. J-55 casing; 8⅝-in. 40-lb. N-80 casing; 3.11-in. neat cement; 3.625-in. concrete.
6	5	5½-in. 17-lb. J-55 casing; 8⅝-in. 40-lb. N-80 casing; 3.11-in. neat cement; 5.5-in. concrete.
7	6	7-in. 28-lb. N-80 casing; 10¾-in. 40.5-lb. N-80 casing; 3.02-in. neat cement; 2.5-in. concrete.
8	7	5½-in. 17-lb. J-55 casing; 7-in. 28-lb. N-80 casing; 9⅝-in. 55-lb. N-80 casing; 1.15-in. neat cement.*
		Soft-Metal Liners—Normal Charge
1	2	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 7-in. river sand
2	2	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; indeterminant depth in river sar.d†
3	2	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; indeterminant depth in river sand†
4	3	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 4.125-in. concrete.
5	3	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 5-in. concrete.
6	3	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 4.2-in. concrete.
		Hard-Metal Liners—Heavy-Duty Charge
1	2	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 7-in. river sand.*
2	3	5½-in. 17-lb. J-55 casing; 1.25-in. neat cement; 7-in. concrete.*
3	6	7-in. 28-lb. N-80 casing; 10¾-in. 40.5-lb. N-80 casing; 3.02-in. neat cement; 4⅛-in. concrete.*
		Soft-Metal Liners—Heavy-Duty Charge
1	1	7-in. 28-lb. N-80 casing; 1-in. neat cement; 6.5-in. concrete.*
2	4	7-in. 28-lb. N-80 casing; 1-in. neat cement; 6.5-in. river sand.*
3	4	7-in. 28-lb. N-80 casing; 1-in. neat cement; 6.5-in. river sand.*
4	5	5½-in. 17-lb. J-55 casing; 8⅝-in. 40-lb. N-80 casing; 3.11-in. neat cement; 5.5-in. concrete.*
5	5	5½-in. 17-lb. J-55 casing; 1.13-in. neat cement.
7	7	5½-in. 17-lb. J-55 casing; 7-in. 28-lb. N-80 casing; 9⅝-in. 55-lb. N-80 casing; 1.14-in neat cement.*
8	7	5½-in. 17-lb. J-55 casing; 7-in. 28-lb. N-80 casing; 1.15-in. neat cement.
		Soft-Metal Liners—Open-Hole Charge
1	..	7¼-in. limestone formation outcrop.
2	..	½-in. steel plate; 14½-in. hard sandstone formation outcrop.
3	6	7-in. 28-lb. N-80 casing; 10¾-in. 40.5-lb. N-80 casing; 3.02-in. neat cement; 4⅛-in. concrete; ½-in. steel plate; 14-in. into ground.

*Indicates complete penetration of testing unit. Further penetration indeterminate.
†Hole in unconsolidated river sand closes after passage of jet.

er effect on the pipe. Also, the problem of having steel particles in the hole or pipe which interfere with the running of packers can be overcome by the use of the disintegrating soft-metal liners.

Plans are being completed for the actual testing of the perforation process in a well from which the perforated pipe can be withdrawn. The well will be filled with fluid, and a section of two concentric cemented joints of casing will be lowered on a wire line. The charges will be placed inside these joints of casing and detonated at the bottom of the well. After perforating, the pipe will be withdrawn and examined for effects that might differ from those observed in the surface tests.

Double-Ended Charges

Since the execution of the above-described tests, a double-ended charge has been designed and proved successful. This charge, with no additional explosive, emits a jet from both ends as it is detonated from its midpoint. In addition to doubling the number of holes in the pipe with any given number of charges, this design enables a greater per cent of the energy to be utilized in penetrating the pipe, with correspondingly less amount of extraneous energy available for detrimental effect on the pipe. Further experimental work is also being conducted using liners of various shapes and materials, with the view of giving a wider range of hole characteristics. The problem of operation in high-temperature wells is well along toward final solution, as a result of development work now being conducted on the casing perforation process by the research staff of E. I. duPont de Nemours Co. Further experimental work is being conducted in active oil wells under varying conditions, and this work is being expanded to a semicommercial basis as rapidly as the present equipment shortages permit.

Reference

1. "A Study of Some Factors Affecting Gun Perforating," S. C. Oliphant, Stanolind Oil & Gas Co., Houston, and B. Floyd Farris, Stanolind Oil & Gas Co., Tulsa, A.I.M.E. meeting, Galveston, October 1946.

Anglo-Iranian Production Shows Gain in August

LONDON.—Iranian crude-oil production of Anglo-Iranian Oil Co., Ltd., in August totaled 1,545,000 tons—about 10,815,000 bbl. or 350,300 bbl. daily. This total compares with 1,254,000 tons—8,778,000 bbl. or 283,300 bbl. daily in July.

Total production from January 1 of this year through August 31, was 12,724,000 tons—89,608,000 bbl. or 366,500 bbl. daily.

PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Composition of Aluminum Alloys

THE alloy numbers (Aluminum Co. of America) of the common aluminum alloys are:

Cast	Wrought: Strain hardened	Wrought: Heat treatable
13	2	14
43	3	17
85	52	A17
122		24
A132		25
142		27
195		A51
B195		53
214		61
A214		..
220		..
355		..
356		..

The chemical composition of these alloys is shown in Table 1 and the forms in which wrought alloys may be had is shown in Table 2.

Cast Alloys

Alloys 13 and 85 are used for die casting. These compositions permit fine finishes, close tolerances, dimensional accuracy (0.0025 in.) thin sections (0.03-0.04 in.) and even cored holes are ready for tapping or reaming.

Alloys 43, 195, 214, 220, 355, and 356 are the types used for ordinary sand castings. In general, and with proper heat treatment, these casting alloys are characterized by:

43—Fluidity allows complicated or thin wall castings.

195-T4—Strong and shock resistant.

214—Maximum corrosion resistance.

220-T4—Good physical properties but not leak resistant.

355-T6—Maintains strength to 400° F. and is leakproof. Used for water-cooled cylinder heads.

356-T4—Complicated castings. A substitute for 195-T4.

Permanent mold casting alloys are Nos. 43, 122, A132, 142, B195, A214, 355, and 356. Alloys 122, A132, and 142 are used for engine pistons, shoes and bearing caps. The A132 alloy has a very low coefficient of expansion and the lowest weight.

These alloys are substantially pure aluminum and can only be hardened or strengthened by "cold working" operations. The outstanding properties are corrosion resistance and ease of bending, welding, forming and skinning. Thus, they are used for tubing, conduit, tanks, aircraft cowling, wire, rivets, etc. They may be used in the annealed or soft condition (as 2SO, 52SO, etc.) or may be hardened in varying degrees by "working" to such conditions as 3S1/4H, 3S1/2H, 3S3/4H, and 3SH.

TABLE 2—AVAILABLE SHAPES OF WROUGHT ALLOYS

Alloy—	Shapes
2S and 3S	Bar
	Sheet
	Tubing
14S	Forgings
17S	Bar
	Sheet
	Tubing round
	Tubing streamline
	Forgings
Alclad 17S	Sheet
24S	Bar
	Sheet
	Tubing round
	Tubing streamline
Alclad 24S	Sheet
25S	Forgings
A51S	Forgings
52S and 53S	Bar
	Sheet
	Tubing
61S	Sheet
	Tubing

TABLE 1—COMPOSITION OF COMMON ALUMINUM ALLOYS—PER CENT

Alloy—	Copper	Iron	Silicon	Magnesium	Nickel	Zinc	Aluminum	Manganese	Chromium
Casting alloys:									
13	...	...	12.0	...	...	...	rest	...	...
43	...	...	5.0	...	...	...	rest	...	...
85	4.0	...	5.0	...	...	...	rest	...	...
122	10.0	1.2	...	0.2	...	...	rest	...	...
A132	0.8	0.8	12.0	1.0	2.5	...	rest	...	...
142	4.0	...	...	1.2	2.0	...	rest	...	...
195	4.0	...	...	...	...	...	rest	...	...
B195	4.5	...	2.8	...	...	...	rest	...	...
214	...	...	...	3.75	...	...	rest	...	...
A214	...	...	...	3.75	...	2.0	rest	...	...
220	...	...	...	10.0	...	...	rest	...	...
355	1.25	...	5.0	0.5	...	...	rest	...	...
356	...	...	7.0	0.3	...	...	rest	...	...
Strain-hardened alloys:									
2S	...	...	...	...	...	...	*99	...	...
3S	†0.2	...	...	...	...	...	*97	1.0-1.5	...
52S	†0.7	...	...	2.2-2.8	...	...	*96	...	.15-.35
Heat-treatable alloys:									
14S	3.9-5.0	...	0.5-1.2	.2-.75	...	...	*92	.4-1.2	...
17S	3.5-4.5	...	...	.2-.75	...	...	*92	.4-1.0	...
A17S	†2.5	...	...	0.3	...	...	...	...	...
24S	3.6-4.7	...	...	1.25-1.75	...	...	*92	.3-.9	...
25S	3.9-5.0	...	.5-1.2	†0.02	...	...	*92	.4-1.2	...
A51S	†0.3	...	.6-1.2	.45-.8	...	...	*96.5	†0.2	.15-.35
53S	†0.05	...	.5-.9	1.1-1.4	...	...	*96	...	.2-.3
61S	...	...	.4-.8	.8-1.2	...	...	*98	...	†0.35

*Minimum. †Maximum.

Heat-Treatable Wrought Alloys

The most widely used alloys in aircraft construction are 17S and 24S, although 14S, 25S and 53S are sometimes used. Heat treatment is required for 17S and 24S rivets but rivets of A17ST, 53SO, 53SW, and 53ST can be driven as received. The corrosion resistance of 53S and of 61S is excellent and the 61S material has good strength.

Free-Machining Steels

ALTHOUGH free-machining steels and alloys have permitted fabricators to operate on a mass-scale basis in the production of many somewhat intricate small parts and although such parts exhibit a good surface or finish, such steels tend to be brittle and in some instances dangerous for the exacting services of the petroleum industry. This important subject was discussed by Holmberg and Prange of Phillips Petroleum Co. before the A.S.M.E. meeting in Tulsa, October 14-16. "Some Notes on the Use of Free-Machining Steels in Connection with Petroleum Equipment" does not place the blame for failure with such steels entirely on steel manufacturers but on operators in the petroleum industry who are not properly cautious in the use of free-machining alloys.

Difficulty has arisen primarily because the ordinary physical test properties of the free-machining steels do not indicate the brittle nature of these materials. Such steels should not be used where toughness or energy absorption is required, "that is to say, where the finished piece may be subjected to overloading or plastic deformation so as to accommodate itself in the structure." Some of the free-machining steels are no better than cast iron for such services. Examples of such unsuitable uses are bolts, pipe fittings, bull plugs, swages, valves, many machine parts, etc. Particular attention is directed toward free-machining stainless steels. These steels are used primarily for corrosion resistance, and yet the addition of sulfur to gain free machining destroys, to a large extent, the resistance to corrosion. Sometimes corrosion occurs 50 times more rapidly.

The free-machining steels most frequently encountered in the petroleum industry are B-1100 series (Bessemer resulfurized), C-1100 series (open-hearth resulfurized), Type 303 stainless (resulfurized 18-8, sometimes selenium is used), and Type 416 stainless (resulfurized 12 chromium).

Proper Control of Oil Reservoirs

by Don R. Knowlton

This article is in the nature of a "ready reference" on the objectives and desirability of reservoir control, gas and water-injection operations, and unitization agreements, and is from the presentation at the winter quarterly meeting of the Interstate Oil Compact Commission at Dallas earlier this month. The author has a broad background in petroleum engineering and production management. He is a graduate of University of Colorado, specializing in geology, and a graduate of Stanford with a degree in engineering. He was with Phillips Petroleum Co. for many years, was national director of production with PAW in Washington for 2½ years during the war, and later was executive vice president of Phillips Venezuelan Oil Co. and manager of Phillips foreign department before forming his own consulting firm, Knowlton Engineering Co., at Oklahoma City.

The Oil Reserve Picture

1. During the 25 years prior to World War II, new oil discovered averaged 1¾ times the volume of oil produced. This desirable situation persisted until 1939 when, for the first time in many years, new reserves discovered did not equal the oil produced. During both 1944 and 1945, in spite of an intensified exploratory and development program of the industry, more than twice as much oil was produced as was discovered in new fields.

2. New oil pools discovered in the last few years have contained on the average only one-sixth the reserves of fields found 10 years ago. The more cheaply explored potential oil-bearing areas have been largely exhausted.

3. Expense per barrel involved in finding new oil is six times what it was 10 years ago and the average cost per barrel of oil for drilling and equipping a well in the United States has doubled in this time.

4. The total of finding cost, development cost, and operating cost is averaging so much today that the producing industry is more or less trading dollars selling crude for $1.70 per barrel. More than half this cost is incurred in finding new oil.

5. Since 1900 we have discovered about 50 billion barrels of oil, produced over 30 billion, and have nearly 20 billion remaining as known reserves. Over three-fourths of this reserve is in fields discovered more than 10 years ago. We are producing at the rate of over 1.7 billion barrels annually in this country. Simple arithmetic would indicate proven reserves equal to about 12 years supply at present producing rates, but much of this future supply cannot be obtained at the present rate.

Means of Increasing Recovery

There are just two means of accomplishing the desired results: adopt primary reservoir control, and apply secondary recovery methods.

Primary reservoir control is undertaken early in the life of a pool, preferably as soon as the reservoir extent and characteristics can be learned, and involves the use of the best methods presently known to recover every possible barrel of oil at the least possible expense.

Secondary-recovery operations are made later in the life of a pool to recover oil which would otherwise remain because of inefficient and wasteful practices of the past.

Types of Reservoir Drive

There are two principal forces which cause oil to move through a porous formation to a bore hole tapping the reservoir. They are compressed gas or water under pressure.

Gas drive.—Every time a barrel of oil or a cubic foot of gas is removed the pressure drops and the compressed gas expands to keep the space filled. As pressure drops gas comes out of solution leaving the oil with less energy and greater viscosity.

Such fields pass through a vicious cycle of increasing gas-oil ratios and declining pressures until all of the valuable gas energy has been exhausted, leaving a large percentage of dead oil in the reservoir.

Water drive.—Characteristic experience in pools producing oil by water drive is sustained reservoir pressure. If operated so the water drive is completely effective, which means that water can enter the reservoir at the same rate as oil is withdrawn, the reservoir pressure will be nearly the same when the last well has gone completely to water as it was when the pool was opened.

Controlling Use of Natural Reservoir Energy

Certain control measures can be taken where only the natural reservoir energy is to be used for recovering oil.

Gas-cap drive.—Maximum recovery will be achieved only by severely restricting or shutting in any wells which tap the gas cap and producing oil only from wells lower on the structure at rates which will permit them to give up oil with the least amount of gas. If a pool in its early stages has a solution-gas drive, it soon develops gas caps, and the greatest oil recovery will result by producing only the more efficient wells and shutting in the wells which have the highest gas-oil ratios.

Water drive.—Water must be allowed to encroach evenly, flushing the reservoir as it moves up dip, and at a rate that will not allow bypassing and fingering which would leave oil trapped. For maximum recovery, oil production should be restricted to the rate at which water can enter and maintain pressure, but this is seldom economically feasible.

Primary Control More Beneficial

Complete primary control results in minimum development and operating costs. A saving in the number of wells drilled can frequently be made and reduction in or elimination of investment in pumping equipment is usually possible. Reduction of operating costs automatically results with fewer wells or less mechanical equipment.

More complete recovery is achieved by retaining the most possible gas in solution, thus keeping oil in the most fluid state. Input gas is usually available at low cost in the early life of a field and may be unobtainable or prohibitive in cost for secondary recovery operations.

North Burbank.—Discovered in 1920, this pool was drilled on 10-acre

locations and produced wide open so the gas energy was rapidly dissipated. In 26 years it has produced 9,500 bbl. per acre which is the amount it would have produced ultimately were it not for the fact that some gas injection has been practiced. By this secondary-recovery effort it is expected that another 1,500 bbl. per acre can be salvaged in another 20 years of operation. The total expected recovery is 11,000 bbl. per acre or 18 per cent more than recovery without gas injection.

South Burbank.—Discovered in 1934, in this pool two-thirds of the acreage was unitized a year later and gas injection started immediately. Wells were drilled on 20-acre locations. In 11 years it has produced 12,000 bbl. per acre and is expected to produce for another 18 years, recovering a total of 17,500 bbl. per acre. Without gas injection the most to be expected was 9,400 bbl. per acre. Thus, gas injection will bring about 87 per cent greater recovery.

North Burbank, initially produced by competitive methods, with later cooperative gas injection as a secondary-recovery effort, will recover 11,000 bbl. per acre in 46 years. South Burbank, produced from the start under primary reservoir control, will recover 17,500 bbl. per acre in 29 years.

Water Drive More Beneficial

It has long been recognized that fields having efficient water drive, properly controlled, recover a larger portion of the oil in place than those depending upon gas energy for their productive force. Theoretical considerations, laboratory experiments, and field results all support this conclusion.

This same conclusion is borne out by secondary-recovery operations where water flooding shows higher recovery than gas cycling or gas or air repressuring. Is it not, therefore, entirely logical to start with the premise that if a water drive can be properly applied and controlled in a reservoir it should be given first application?

Reservoir Control Involving Addition of Energy

The most complete control of reservoir performance and greatest conservation is possible when energy is returned or added to the reservoir either in the form of higher-pressure gas or water under pressure in the early life of all fields except those having an effective natural water drive.

Increased recovery and reduced operating costs usually result because:

1. Bottom-hole pressure may be maintained at a high value or allowed to decline at a controlled rate and may be kept uniform throughout the reservoir. The ratio of gas to oil produced may be kept to a minimum. The flowing life of the wells may be prolonged even to the date of economic depletion of the wells.

2. In a gas drive pool all produced gas should be returned to the formation and oil should be produced from only the lowest ratio wells at such rates that uniform bottom-hole pressures are maintained over the field. Maximum possible recovery will usually be attained if additional gas from sources outside the pool is injected to augment the supply of energy.

3. In cases where the water drive is inadequate to sustain an economic or desired rate of withdrawal of the oil, water may be added on the flanks of the structure to create an effective artificial water drive. An outstanding example of such an operation is furnished by the great East Texas field. It has been estimated that the natural water drive in this field would ultimately recover 5 billion barrels of oil, 37,000 bbl. per acre, or 80 per cent of the oil originally in place. Here, in spite of restricting daily withdrawals to less than 20 bbl. of oil per well the natural water drive did not maintain bottom-hole pressure. By reinjecting the produced salt water and thus bolstering the natural water drive an additional amount of between 200 million and 800 million barrels of oil is expected.

Cooperative Control Gives Limited Benefits

Cooperative effort toward primary reservoir control means that each producer attempts to operate his property in a manner similar to that employed by his neighbors but the lease owner still has to obtain his return solely from wells on his lease. In cooperative gas-injection projects, for example, the degree of cooperation usually has been limited to a jointly developed and operated compressor plant. Each operator can inject gas on his own lease and attempt to produce his share of the oil from the wells having lowest gas-oil ratios but if the wells tapping the portion of the reservoir delineated by his lease lines cannot produce oil without extravagant use of gas, he is forced to permit wastage of energy in order to get his production of oil.

Primary pressure maintenance by injection of water is seldom feasible under a cooperative plan of operation since water usually must be introduced on edge leases.

A cooperative agreement can establish well spacings and drilling patterns but cannot eliminate drilling of wells required by offset obligations.

Cooperative primary reservoir control can be expected to produce worth while benefits and always should be attempted if the more complete control permitted by unitized operation cannot be arranged.

Unitization means a pooling of all wells and leases, the allocation to individual owners of undivided interests in the unit, and the development and operation by a committee representing all interest holders. The ideal situation is created when royalty interests and working interests are both unitized.

Development costs.—Material savings are made possible by unitization early in the life of a pool. Frequently, the number of wells drilled can be reduced to one-half, or less, of what would be drilled for competitive operation.

The unit cost for drilling and completing wells will be less since a scheduled drilling program can be followed and completion methods and materials standardized. When a field is drilled up competitively, efficiency in conduct of the work is of a very low order since the primary motive is to get wells on production quickly.

When royalty is unitized the development requires a minimum of lease tankage and gathering lines, and maximum benefit can be had from wells drilled by being able to locate them at the most effective positions on the structure without regard to surface lease lines.

Total savings in development costs will vary with the field circumstances but a typical average would be one-half the amount required under competitive development. Average development cost of the industry is now about 40 cents per barrel of recoverable oil or one-fourth the total cost per barrel for finding, development and producing.

Operating costs.—Operating costs also are less under unitization. With fewer wells and less equipment to operate and maintain both labor and material costs are reduced. Duplication of overhead is eliminated and minimum personnel and service facilities are required.

The most effective operating methods can be adopted since the reservoir can be treated as what it is in fact, a common source of supply of oil with a common source of energy. Gas-cap injection of gas can be undertaken if that promises to be most effective, five-spot gas injection can be used, water injection can be used, or desirable combinations of gas and water.

Pilot operations can be undertaken at the most propitious locations on the structure and results largely predetermined.

Typical Results of Unitization

Schuler-Jones sand pool, Union County, Arkansas.—Discovered in 1937, original bottom-hole pressure 3,520 psi. In 3½ years the average pressure had dropped to 1,542 psi. with a differential of 1,200 psi. between the high and low-pressure area. After a year and a half of strenuous effort on the part of interested producers, an agreement was reached for unitized operation and pooling of

(Continued on page 278)

UTILIZATION OF OIL-WELL GAS

In New Texas-California Pipe Line

by W. K. Davis*

IN August 1945 El Paso Natural Gas Co. filed application with Federal Power Commission for the necessary certificate to permit the company to construct and operate a 26-in. pipe line to California. On May 31, 1946, the commission granted our application exactly as requested. On July 2, 1946, we concluded the necessary financing and on July 23, 1946, placed $42,212,000 cash in the bank as a construction fund for the completion of the project.

This line will perform two important public services. It will provide a market for a minimum of 125,000,000 cu. ft. of residue gas per day that otherwise would be blown to the air, and it will supplement the decreasing gas supply of Southern California, one of the most populous and fastest growing areas in the United States.

*Production superintendent, El Paso Natural Gas Co., Jal, N. M. Paper presented at the joint meeting, Texas sections, A.I.M.E., at University of Texas, Austin, December 18-19.

Details of Design

This project, when completed, will consist of approximately 737 miles of 26-in. pipe extending from a point near Jal, N. M., through southern New Mexico and southern Arizona to a point on the California-Arizona line near Blythe, Calif. (See map). The solid black line represents the existing pipe-line system. The dotted line represents the new pipe line to California. The dark circles represent the proposed compressor stations. The cross-hatched line represents that portion of the line to be constructed and operated by the California companies.

The pipe line is designed to operate at 810 lb. pressure with a maximum operating pressure of 838 lb. The pipe will be one-half 0.291 wall thickness and one-half 0.281 wall thickness, with the 0.291 wall pipe on the discharge side of the compressor stations and the 0.281 pipe on the suction side.

The line from Dumas, Tex., to Eunice, N. M., will be 24 in. in diameter and 251 miles in length. The field-gathering system will consist of 31 miles of 14-in. pipe from the Eunice plant to the Fullerton field, and 31 miles of 16 in. from the Jal No. 1 plant to the Keystone and TXL fields. There will be 46.5 miles of 14-in. pipe laid from the Jal No. 1 plant

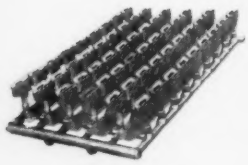
Gas fields, compressor stations, dehydrator units, gasoline plants, and lines involved in the project described in this article. (A map of the California portion of the project was published in The Oil and Gas Journal issue of September 21, 1946, page 204)

WECO PRODUCTS

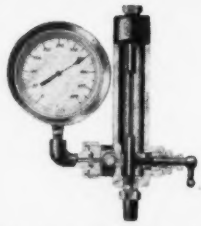
Serve the Oil Industry

Okadee Blow-off Valves

WECO Fusible Plugs



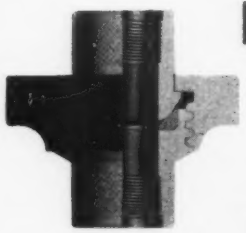
Anchor Low Pressure Gas Burners



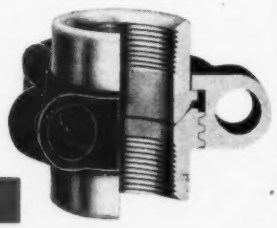
WECO Steam Gauge Protectors

Markle Canvas Windbreaks and Engine House Frames

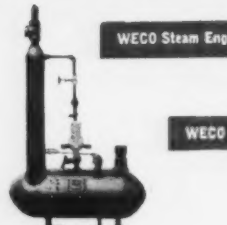
WECO Snatch Blocks



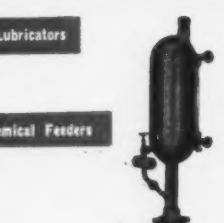
WECO Dizzy Thread Wing Unions (6000 lbs.)



WECO Screw Thread Hammer-Bar Wing Unions (1000 lbs.)



WECO Steel-Aid Thread Compound (Lead Base)



WECO No-Gall Tool Joint Dope (Zinc Base)

WECO Steam Engine Lubricators

WECO Chemical Feeders

WECO

Manufacturers and Distributors of Oilfield, Refinery, Marine and Industrial Equipment

WELL EQUIPMENT MFG. CORP.

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to the Pecos River where it will join the 23-in. line from the Eunice plant.

The ditch will be 42 in. wide and 56 in. deep giving a 24-in. cover over the pipe. In general, the ditch will be dug with a ditching machine except in the mountain passes such as the Guadalupe Mountains, Stien's Pass, and Apache Pass, where dynamite and backhoe machines will be necessary. Suspension bridges will be built over the Canadian, Pecos, San Pedro, Gila, and Colcrado rivers and a structural steel bridge over the Rio Grande River.

In general, the soil conditions are not too bad. However, cathodic stations will be installed at the necessary intervals to protect the pipe from electrolysis and all of the pipe will be primed, coated, and wrapped to protect it from corrosion (primed with regular primer and coated with coal-tar pipe-line enamel and wrapped with 15-lb. felt paper).

Scheduled Operations

In the first year's operation under the 125,000,000-cu.-ft.-per-day delivery, it will be necessary to install one main-line compressor station and the necessary compression in connection with the field gathering system.

In the second year of operation, which calls for the delivery of 175,000,000 cu. ft. per day, the company will lay a line to Dumas for the purpose of picking up 50,000,000 cu. ft. of gas per day from the Panhandle field in North Texas. It also will be necessary to construct and operate one additional compressor station on the main line to meet the above deliveries.

The outstanding feature of this project is that it provides a market for a vast amount of oil well gas that has been going to waste in West Texas and Southeastern New Mexico for a number of years. It is unique in that it is the first large gas-transmission line to market over 75 per cent of its total requirements from residue or oil well gas.

During the first year's operation the gas to be marketed will be 100 per cent residue gas or oil well gas. This gas will be taken from the Eunice and the Monument fields in New Mexico and the Fullerton, Keystone, and TXL fields in West Texas.

It is expected that it will require approximately 1 year to construct the initial stage and approximately 18 months to complete the pipe line to a capacity of 175,000,000 cu. ft. per day.

When the maximum capacity of the line is reached, which is 305,000,000 cu. ft. per day, it will be necessary to have installed six main-line compressor stations and seven field-compressor stations having a total of 131,800 hp. in operation. In addition the company will be operating several desulfurization and dehydration plants necessary to prepare the gas for distribution. The project also includes many automatic devices which will make it one of the most complete pipe lines in the world.

The initial proposal involved the marketing of 125,000,000 cu. ft. per day of residue gas produced in connection with oil in the Permian basin fields in Southeastern New Mexico and West Texas, which gas is otherwise being blown to the air. However, in order to permit entering into a long-term contract with the California companies and to satisfy the requirements for financing the new project, it was necessary to broaden the base of supply by attaching reserves of so-called "dry gas" not associated with the production of oil.

Contracts for Residue Gas

To this end, the El Paso company contracted with Phillips Petroleum Co. for deliveries of 75,000,000 cu. ft. of residue gas per day from four gasoline-absorption plants located in oil fields near the eastern terminus of the new 26-in. line, and for an initial supply of 50,000,000 cu. ft. per day of dry gas to be produced from the western portion of the Panhandle field in Moore County and adjacent counties in North Texas and from the southern portion of the Hugoton field in Sherman County, Texas. The El Paso company has the right under certain circumstances to increase its takings of dry gas from the two last-mentioned fields up to a maximum of 180,000,000 cu. ft. a day.

The El Paso company also contracted with Gulf Oil Corp. for 30,000,000 cu. ft. per day residue gas from a gasoline-extraction plant to be built by Gulf in the Keystone field in Winkler County, Texas; with Shell Oil Co., Inc., for 20,000,000 cu. ft. daily residue gas from a gasoline-extraction plant to be built by Shell in the TXL and Wheeler fields in Ector County, Texas; and with Warren Petroleum Corp. for 10,000,000 cu. ft. residue gas from the Monument field in Lea County, New Mexico. These contracts are for terms from 15 to 25 years. The average purchase price of a reasonable quantity of gas at any central location is 3½ cents per 1,000 cu. ft. for the first 5-year period, with the price gradually increasing each succeeding 5-year period thereafter for the term of the contract.

Delivery to California Companies

On December 17, 1945, the El Paso company entered into a contract with Southern California Gas Co. and Southern Counties Gas Co. of California, under which the El Paso company undertakes to deliver to them at the Colorado River near Blythe, Calif., up to 125,000,000 cu. ft. of natural gas per day during the first year of the contract term. This goes up to 175,000,000 cu. ft. of gas per day thereafter, with an option to the California companies, exercisable on or before September 1, 1949, to increase their takings under the contract to a maximum of 305,000,000 cu. ft. of natural gas per day.

The California companies are to construct a line from the point of delivery at the Colorado River to a connection with their present distribution system near Los Angeles. (For details of the California section of the line, see The Oil and Gas Journal "Annual Pipe Line Number," September 21, 1946, pp. 204-215). The contract, which is to continue for a term of 30 years from the initial delivery of gas thereunder, obligates the California companies to receive minimum deliveries, averaged over the year, of 91 per cent of the maximum contracted daily demand from time to time in effect as indicated previously.

Upon application of the California companies and after hearings, the California Commission on February 5, 1946, issued its opinion and order approving the construction of the line from Blythe to Los Angeles, and emphasizing the need of the two California companies to obtain additional gas to supplement the diminishing supplies available to them from California sources and to enable them to meet the full anticipated demands from their service areas.

The California companies also made application to FPC for authority to construct and operate their portion of the new project as an interstate line. Such application was, by order of the commission, consolidated with the El Paso company's application for purposes of hearings, and an initial hearing on the two applications, for the presentation of direct evidence, was had in Washington in February of this year. Further hearings for additional direct evidence and crossexamination were had in Los Angeles from April 8 to 15, 1946. No organized opposition to the applications appeared at any of the hearings; on the contrary, the city of Los Angeles, the city of San Francisco, and the Chamber of Commerce of Los Angeles, through their respective representatives, appeared at the hearing in Los Angeles and urged the granting of the applications.

In preparation for the hearings we presented over 200 exhibits showing the estimated available reserves for all of the major fields in the Permian basin, the engineering design and the proposed financing of the entire project for a 30-year period.

During the FPC hearing in Los Angeles, executives of the California companies stated on the record their conviction that their companies would need the full 305,000,000 cu. ft. of gas per day, in all probability at an earlier date than was originally contemplated, and made a formal offer to exercise at this time their election to take the full 305,000,000 cu. ft. per day, pursuant to the terms of the contract, if FPC should deem such

action on their part necessary to permit the issuance of unconditional certificates of public convenience and necessity covering the entire new project, as asked by the El Paso company and the California companies. The commission, however, did not require the exercise of the option prior to September 1, 1949, but granted the certificate for the full 305,000,000 cu. ft capacity conditioned only upon the exercise of the option by September 1, 1949.

Use of Residue Gas by El Paso

The marketing of sizable quantities of residue gas is not a new experience to the El Paso company. In the operation of the existing pipe lines in New Mexico and Arizona they have been utilizing various quantities of residue gas in the company's system since 1940 and in 1945 approximately 65 per cent of the system's total requirements were from residue gas. In 1940 they constructed a gasoline absorption plant in the Langlie-Mattix area in Lea County, New Mexico, and at the same time installed the necessary compression to boost approximately 8,000,000 cu. ft. per day into the main lines for delivery through the transmission system.

In 1942 additional compressors were installed in the plant in the Langlie-Mattix area and a residue compression plant was constructed in the Eunice field to utilize residue gas that was blowing to the air from Phillips Petroleum Co.'s Oil Center gasoline plant.

In 1945 additional compressors were added to the Eunice plant which allowed increased residue gas takes from the Phillips gasoline plant in the Eunice field and from the Warren gasoline plant in the Monument field in Lea County, New Mexico.

In 1941 the average amount of gas sold through the El Paso company's main line was approximately 90,000,000 cu. ft. per day. Of this amount, approximately 8,000,000 cu. ft. per day or 9 per cent was residue gas.

In 1943 the average daily amount of gas sold through El Paso company's main line was approximately 105,000,000 cu. ft. Of this amount approximately 45,000,000 cu. ft. or 43 per cent was residue gas.

In 1945 the average daily amount of gas sold through the El Paso company's main line was approximately 115,000,000 cu. ft. Of this amount approximately 75,000,000 cu. ft. per day or 65 per cent was residue gas from fields in Southeastern New Mexico.

On the basis of this operation the El Paso company was convinced that it could construct and operate a large gas-transmission line that utilized residue gas in conjunction with a dry gas reserve attached to the system, provided that it could contract for residue gas produced from oil reservoirs with a sufficient reserve to warrant several years of operation of a compressor, desulfurization, and dehydration plants.

There are many important factors to be considered in the utilization of residue gas in a gas transmission system. Obviously it would be impossible for a gas company to install and operate equipment utilizing 100 per cent of the total gas produced from any oil field. The most important factors to be considered are the daily variations of available gas within the 24-hour period, the variations of available gas over a monthly period, amount of gas that will be required to be returned to the leases, and the amount of gas required for fuel, absorption, and other purposes for the operation of a gasoline-absorption plant and a compressor plant; the variation of field allowables over a period of time and the estimated future decline of the oil and gas production in the field. All of these factors must be taken into consideration in order for the gas company to be assured of a continuous supply of gas available for the necessary equipment required to compress the gas from low pressures to high pressures. If the above factors were not considered it would be possible to have a situation where large sums of money would be tied up in equipment which would be idle a large part of the time and thereby create an excess cost per 1,000 cu. ft. of the gas.

Another important factor to be considered in this connection is the possibility of any repressuring within field. This, of course, is looked upon favorably by a gas company due to its conservation of natural gas. However, it is desirable that the repressuring agreements be consummated prior to the installation of residue equipment, so that definite and continuous quantities of gas can be made available over a long enough period of time to warrant the installation of the necessary equipment.

Gas Storage Unit

In 1942 the El Paso company purchased the leases and gas reserves down to 4,000 ft. from several of the operators in the Rhodes area in Lea County, New Mexico, and proceeded to work out a unitization agreement with the federal Government for the purpose of operating a gas-storage project.

The Rhodes unit is favorably situated in respect to the operation of the existing system and the proposed project. It is located about 4 miles southeast of the El Paso company's Jal No. 1 plant, which is just south of the town of Jal, New Mexico. The area has produced gas into our system since the first deliveries of gas by El Paso Natural Gas Co. and consequently a vast amount of information with respect to geological conditions, production history, and pressure records, is available.

It is believed that the storage reservoir will be advantageous in the operation of the existing and proposed pipe line in connection with the utilization of large quantities of residue gas. It is anticipated that this reservoir will be operated as an "in and out" proposition. In the summer time when the deliveries of gas are at a minimum, the excess residue gas will be stored into the storage reservoir rather than shutting down the compressor stations and in the winter months during peak demand periods the gas will be produced into the main line. This is advantageous in two ways: (1) It will conserve residue gas by storing it in the summer and producing it on peak demand in the winter; (2) it will have a stabilizing effect on the dry-gas wells tied to the existing system in that they will not be required to be produced at high rates of production, thereby minimizing the possibility of reservoir damage due to excess production. Also, it will conserve dry gas for future use. This storage reservoir will be valuable as a standby in case of plant or line failure at any point prior to entry of gas into the 26-in. main line. To date 1,100,000,000 cu. ft. has been stored in the reservoir, increasing the average bottom-hole pressure of the unit approximately 110 lb.

There can be little question that the California project will have a very favorable effect on the future conservation of residue or oil well gas and, no doubt, other gas transmission companies will include in their future plans the utilization of all suitable residue gas.

Proper Control of Oil Reservoirs

(Continued from page 274)

royalty, which became effective February 15, 1941. Since that date no more than 50 of the 146 wells have been opened at any one time. Nearly 100 unnecessary wells were drilled and completed at a depth of 7,500 ft. in developing this reservoir, but some of these wells were later used to good advantage under unit operation to produce an upper horizon.

Gas produced with the oil is returned to the gas cap. Bottom-hole pressure decline has been arrested, uniform bottom-hole pressure has been reestablished throughout the field, and it is still 1,600 psi. or slightly higher than when the unit was formed. There already has been produced more oil than would have been recovered without pressure maintenance, and another 20 million barrels is in sight. This would be an increase of 60 per cent in the amount of oil recovered. The savings in lifting costs will apparently be an amount even

greater than the value of the increased oil.

Haynesville-Pettit lime pool, Claiborne Parish, Louisiana.—Immediately after this zone was discovered in 1941 plans were started to conserve and reinject gas into the formation. A unitization agreement was executed May 1, 1944. A pressure-maintenance and hydrocarbon-extraction plant was constructed and the first gas injected in January 1945.

Bottom-Hole-Pressure Decline Arrested

Original bottom-hole pressure was 2,440 psi. and had declined to 1,400 psi. at the time gas injection was started. Further decline has been arrested by returning substantially all the produced gas to the formation.

It is expected this field will produce profitably for another 20 years and that 6,250,000 bbl. of additional oil, or 35,000 additional barrels per well, will be recovered due to the reservoir control practiced.

Midway field, Lafayette County, Arkansas.—This operation is an outstanding example of flank-water injection. Discovered in 1942, it had an original pressure of 2,920 psi. A year later the pressure had declined to 2,665 psi. and was fast approaching the pressure of 2,528 psi. where gas would come out of solution. Resultant high gas-oil ratios would have drastically curtailed production rate and ultimate recovery.

Just prior to starting water injection in April 1943, the field was producing 5,700 bbl. of oil daily. It is believed that in the absence of a pressure-maintenance program the allowable would have been cut to about 3,500 bbl. of oil daily. As a result of water injection the reservoir pressure has been gradually increased and the rate of oil production has been as high as 7,400 bbl. daily. Over twice as much oil is expected to be recovered as would have been without pressure maintenance. This increase would amount to 35 million barrels.

Difficulties of Unitization

The few examples mentioned will indicate the great benefits possible when the most intelligent efforts are put forth in control of oil reservoirs. Perhaps it is only natural to expect that where the potential reward is great the number and magnitude of the obstacles to its attainment should be large. There are a multitude of deterring factors, but the principal hurdles exist because:

1. Too many oil producers cherish their reputations as rugged individualists and enjoy greater satisfaction from trying to make a better showing than neighboring producers than they would from a pooled operation where the gamble is largely removed.

2. Even in this young industry too much inertia is present and a lethargy exhibited when new and different methods are proposed.

3. Operators are too prone to suspect each others' motives. While no one in business dealings is expected to be entirely altruistic, it is a fortunate fact that an increasing number realize that improvement of the group of which they are a part includes improvement of their own lot.

4. In attempting negotiation of unit operating agreements, the representatives entrusted with this important work too often assume a supertechnical and highly legalistic attitude. The time lost in deliberations could be greatly reduced and some unsuccessful efforts converted to success if the negotiators were always men who would make concessions, if need be greater than those made by others, to attain the large benefits resulting in the end.

5. The laws in several states are deterrents to unit operations.

Japan to Import Crude

TOKYO. — Approval by Allied Headquarters of a plan under which Japan will import more than 77,000 bbl. of crude oil a month for use in speeding up Japan's steel-production program was announced here last week by Jiro Hoshijima, minister of commerce and industry.

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Water Treating: Coagulation

COAGULATION or flocculation is that process whereby finely divided particles of turbidity and color capable of remaining in suspension indefinitely are combined, by chemical means, into masses sufficiently large to effect rapid settling.

Use or Purpose

Ordinary subsidence often does not produce a water sufficiently low in turbidity to be suitable for most supply and process-water requirements. Further retention time is useless, in many cases, due to the extremely small size of the suspended particles. In filtration, such small particles will find their way deep into the filter medium, effectively plugging the filter bed within a short time and requiring frequent backwashings.

Chemistry Involved

Clarifying liquids by coagulation consists in the introduction of a chemical which, upon dissolving, undergoes hydrolysis, forming an insoluble, hydrated metallic oxide known as a "floc." Coagulation is thought to be a complex electrochemical phenomenon.

A large proportion of the impurities to be removed by coagulation is in a colloidal state. For example, these particles may bear a negative charge due to adsorption of negative ions and the material repulsion of the similarly charged units tends to stabilize the colloid system. In order to precipitate the impurities, it is necessary to reduce these negative charges to some critical value by the addition of a coagulant which will contribute positive electrical charges in the form of ions and positively charged colloidal particles.

In addition to true coagulants, some finely divided substances are used to improve floc formation. These materials may serve as seeders to promote larger agglomerates than would be otherwise formed. In this group can be included such substances as activated silica, clay, etc.

Flocculation tests must be made in the laboratory, using various flocculating agents and dosages in order to determine which one is the most effective from the standpoints of chemical cost, floc formation, and ability to do the task at hand. In addition to the laboratory tests, the choice of a coagulant is usually developed from the following: Alkalinity or acidity and pH of the water; mineral content; probable taste and odor conditions; turbidity and color problems; and removal of industrial wastes.

Point 1 in the above list is of prime importance in the selection of a coagulant and every effort should be made to use the natural characteristics of the water to be treated. Proper pH is important, otherwise a good portion of the coagulating medium will remain in solution rather than forming the desired floc.

Mineral content and hardness should further influence the selection of a coagulant. Many natural waters contain an abundance of coagulating ions, sometimes sufficient to coagulate the water if conditions can be transformed to be suitable for their reaction. Such an instance would be the presence of an appreciable amount of iron in the water to be treated. Elevation of the pH of such a water would no doubt effect suitable removal in many instances.

Coagulants

Filter alum [$Al_2(SO_4)_3 . 18H_2O$].—This material is usually applicable to waters within the pH range of 5.7 to 7.5, reacts with the natural alkalinity of the water and hydrolizes to form a floc which, for simplicity, can be shown as the hydrated oxide of aluminum, $Al(OH)_3$, according to the following equation:

$$Al_2(SO_4)_3 + 3Ca(HCO_3)_2 \rightarrow 2Al(OH)_3 + 3CaSO_4 + 6CO_2$$

Copperas ($FeSO_4 . 7H_2O$).—The natural alkalinity of most waters is not sufficient to react with copperas to form the desired ferric hydroxide floc. Lime or another alkali must be added to produce this result. The first reaction with lime produces ferrous hydroxide which in turn is oxidized by the dissolved oxygen in the water to form ferric hydroxide. This oxidation generally occurs at a pH between 9.0 and 11.0, requiring additional lime to supply the alkalinity. The need for using considerable lime prevents the general use of this material except where lime is also needed for water softening.

Chlorinated copperas.—Copperas is oxidized by chlorine over the entire range of pH values of natural waters to form ferric chloride and ferric sulfate, both of which are coagulants. Its field of usefulness is the same as either ferric chloride or ferric sulfate alone with the exception that copperas is more easily handled than ferric coagulants. Chlorinated copperas is especially applicable where the water supply is pre-chlorinated.

Sodium aluminate ($Na_2Al_2O_4$).—Sodium aluminate is actually aluminum oxide stabilized with caustic soda. A good commercial grade contains about 55 per cent aluminum oxide, 35 per cent combined caustic, and 6 per cent excess caustic. This material may be used in place of an alkali in water which must be coagulated with alum in a higher pH zone. In this case, a smaller alum dose plus a moderate dose of sodium aluminate may give better coagulation in the alkaline zone than a larger alum dose plus soda ash or lime.

Equipment Employed

Modern installations introduce the coagulant, the proper dosage having been determined by laboratory tests, to a small mixing tank where, by mechanical means, the coagulant is thoroughly and rapidly mixed with the incoming raw water. This treated water is then discharged into a flocculating basin. Due to the thoroughness with which the coagulant is introduced and mixed, this part of the process is known as "flash mixing."

After flash mixing, the treated water is discharged to a flocculating basin where the formation of floc is encouraged mechanically.

After proper mixing and floc formation have been accomplished, the treated water is passed into a so-called sedimentation basin. In these basins, the rate of flow is sufficiently slow (approximately 0.5 ft. per minute) to cause a rapid settling of the floc. A retention time of 2 to 6 hours is usually sufficient. Larger installations usually have provisions for continuous sludge removal, so that there will be no holdup of sludge which may affect the taste or quality.

This material is from the Betz Handbook for Industrial Water Conditioning, written and published by W. H. and L. D. Betz, consulting engineers, Philadelphia.

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PIPE LINES

Inch Lines Deliver Gas To Six Connections

NATURAL gas is being delivered from the big-inch and little big-inch lines to six eastern connections, according to J. P. Bristow, vice president, Tennessee Gas & Transmission Co., which has contracted operations of the system for gas transmission until the end of April 1947.

Early this week these connections were as follows: Three for Ohio Fuel Gas Co. lines; and one each for East Ohio Gas Co.; Manufacturers Light & Heat Co.; and Equitable Gas Co. Two more connections are to be made soon. With the exception of the connection with The Equitable Gas Co. system near Waynesboro, Pa., connections between the inch lines and natural-gas pipe-line systems are located in Ohio and West Virginia.

Early this week deliveries were being made at the rate of 100,000,000 cu. ft. daily at approximately 150 psi. Input pressure at the Many, La., connection between T. G. & T. and the little big-inch products line was between 600 and 700 psi.

An injunction restricting operations of Producers Coal Co., Carrier Mills, Ill., was issued by U. S. District Judge Fred L. Wham in Centralia, Ill., last week in a move to guarantee safe operations of the big-inch lines. The restraining order was sought by Reconstruction Finance Corp., which charged the coal company's operation of a strip pit mine adjacent to the two lines threatened them with "irreparable damage."

In Pennsylvania, Gov. Edward Martin authorized emergency tapping of the lines by Equitable Gas Co. of Pittsburgh to help fill an "urgent need of additional supplies of natural gas." The executive wired the company's president, Ward Perrott, the state will raise no objections to taking gas from the lines at least until next April 30.

Meanwhile in Marshall, Tex., Hunt Oil Co. was reported clearing land in the Whelan pool area in northwest Harrison County for construction of a dehydration plant, preparatory to connecting four gas wells into the larger big-inch line.

Michigan-Wisconsin Co. Has Chicago Headquarters

Frank L. Congrad, president, Michigan-Wisconsin Pipe Line Co., has headquarters at 105 W. Adams St., Chicago, Ill. This company, now making preparations to build a 1,069-mile transmission line of 22-in. and 26-in. pipe from Hansford County, Texas, to Big Rapids, Mich., is a subsidiary of Michigan Consolidated Gas Co., which, in turn, is controlled by American Light & Traction Co.

Great Lakes Operates Three New Terminals

Great Lakes Pipe Line Co. has just put in operation the recently completed terminals on the following dates: Alexandria, Minn., December 18; Fargo, N. D., December 20; and Grand Forks, N. D., December 27.

The large construction program of the company begun in 1945 is nearly all completed; some work on it is still in progress. This undertaking involved the laying of approximate-

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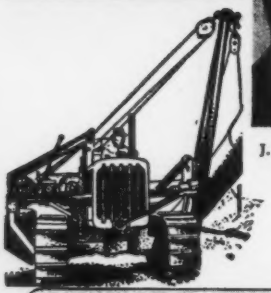

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ly 1,100 miles of refined-products pipe line which furnished facilities for increasing the throughput of the Great Lakes system by 32,000 bbl. daily.

Socony-Vacuum Prepares For Venezuela Pipe Line

Preparations are being made for the construction of the crude-oil pipe line for Socony-Vacuum Oil Co. of Venezuela for delivering oil from the company's fields in eastern Venezuela to Puerto la Cruz. The project will be a 77-mile 12-in. line which will extend north from the Guico field in the Greater Oficina area in the vicinity of San Tome; it will parallel the Mene Grande Oil Co.'s Oficina-Puerto la Cruz 16-in. line to the Guario field in the Greater San Joaquin area; from there it will extend to a connection with the Santa Barbara-Puerto la Cruz trunk line of Cia. Consolidada de Petroleo (Sinclair); this connection will be effected 37.2 km. (about 23 miles) from Puerto la Cruz. Pipe is expected to arrive in February.

The contractor, Williams Brothers Co., is established near Puerto la Cruz where the firm has office, warehouse and shops in the charge of Paul Abbott, manager. Address of this camp is Apartado 59, Barcelona. Operations are still being conducted from this point for the construction of the Guarico Road for a group of oil companies. Alongside of this road it is expected that a pipe line would be laid to transport oil from the State of Guarico when a pipe-line project to serve the area is feasible. Construction work on the "pilot road" phase of the Guarico Road is expected to be completed in April 1947.

Venezuelan operations of Williams Brothers are handled by A. M. Garber, general superintendent, with headquarters at Edificio Phelps, Caracas, where the company maintains an office managed by L. S. Hinson. The Maracaibo office is managed by Charles Williams. David R. Williams and Guy S. Connors, vice presidents of Williams Brothers Co., returned to the United States this week from a visit to the Venezuelan offices.

FPC to Clarify Status of Panhandle Eastern Project

Important aspects of Panhandle Eastern Pipe Line Co.'s expansion program will be determined by a supplemental order to be issued by Federal Power Commission before the middle of January 1947. Execution of Panhandle Eastern's $23,751,550 construction program will necessarily be contingent on this supplemental order. This program for increasing delivery capacity from 393,000,000 cu. ft. to 473,000,000 cu. ft. daily involves the installation of additional compressors and extensive looping with pipe from 18 to 26 in. in diameter.

In a recent order modifying a certificate issued November 30 to Michigan-Wisconsin Pipe Line Co. authorizing a gas pipe line, FPC stated that paragraph (B) (VIII) should be to the effect that the certificate was granted upon the express condition that the facilities authorized shall not be used for the transportation for or sale of gas to Michigan Consolidated Gas Co. for resale in Detroit and Ann Arbor except with regard to the rights and duties of Panhandle Eastern in its established service for resale in these two cities under existing contract with Michigan Consolidated.

A Contract WITH MB MEANS PIPELINE PERFECTION
Pipeline Perfection is the result of 80 years experience among our three key men and 90% new and modern efficient equipment.
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REQUIRED FOR REMOTE OPERATIONS

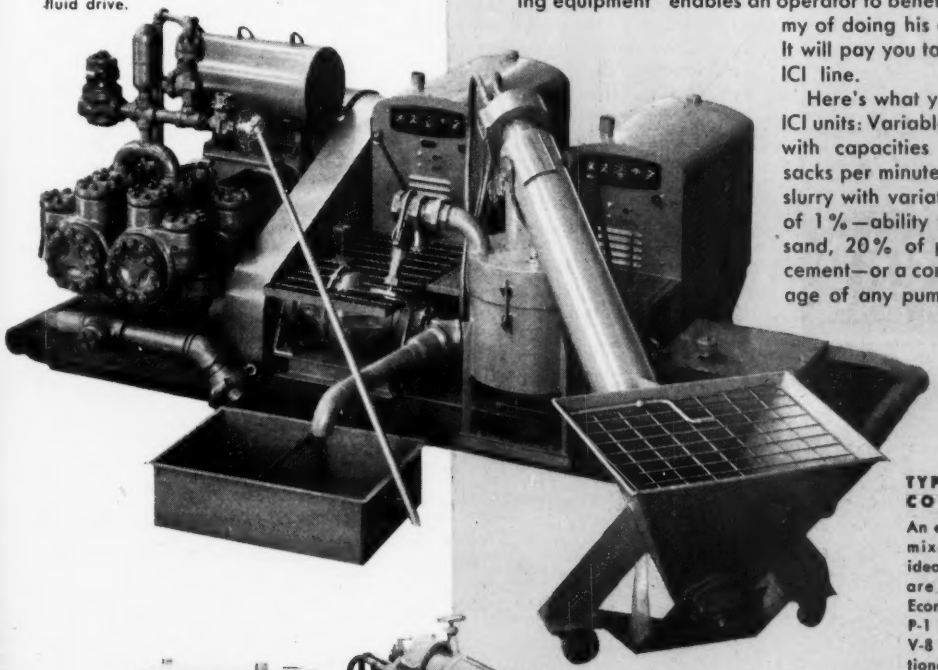
PORTABLE SKID MOUNTED POWER CEMENTING UNIT

Here, in one package, is a complete unit for every type of cementing job. It is equipped with a Gardner-Denver pump powered by a Mercury V-8 engine driving through a four speed transmission. The mixer and conveyor unit has a separate Mercury V-8 engine with fluid drive.

International operators, faced with difficult means of transportation, are depending more and more on ICI portable equipment to help them solve their oil well cementing problems.

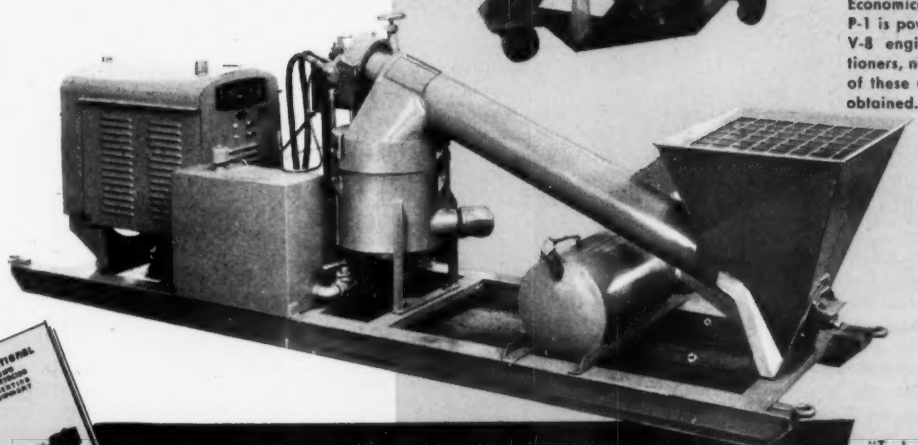
ICI cementing units are designed to meet the specialized requirements of remote operations, and they are economical units for use on the ordinary job. This "engineered cementing equipment" enables an operator to benefit by the economy of doing his own cementing. It will pay you to investigate the ICI line.

Here's what you can get with ICI units: Variable mixing speeds with capacities from 8 to 50 sacks per minute—evenly mixed slurry with variation less than ½ of 1%—ability to mix 40% of sand, 20% of pea gravel with cement—or a controlled percentage of any pumpable add-mix.



TYPE P-1 MIXER AND CONVEYOR

An excellent, highly portable mixer and conveyor unit, ideal where weight and size are prime considerations. Economical to operate, the P-1 is powered by a Mercury V-8 engine. Water proportioners, not shown with either of these units above, can be obtained.



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CHEMICAL MEASURING
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DEPENDABLE

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REFINING

Koppers Submits Bid on U. S. Plant in Oil City, Pa.

War Assets Administration took steps last week toward the disposal of four war-built aviation-gasoline plants, three in Texas and one in Pennsylvania.

Koppers Co., Inc., Pittsburgh, submitted a bid of $1,230,125 for the purchase of the facilities in Oil City, Pa., which were operated during the war by Pennzoil Co. Koppers officials said the plant would be converted to the production of chemicals. The facilities consist of a HF alkylation unit with a production capacity of 1,500 bbl. daily.

In Houston, the regional WAA office set deadline dates for sale or lease of three other refining properties. They are:

At Texas City, facilities operated during the war by Southport Petroleum Co., 13,000 bbl. charging-capacity Houdry catalytic cracking and 1,600 bbl. HF alkylation production; bid deadline, January 20, 1947.

At sweeney, Tex., operator, Abercrombie-Harrison Oil Co., 18,000 bbl. crude charging capacity and 4,700 bbl. cracking; bid deadline, February 3.

At Smith's Bluff, Tex., facilities adjacent to Pure Oil Co.'s refinery; bid deadline, January 3.

New Aircraft Fueling Method Developed By Shell

Development of a new beneath-the-wing method of refueling aircraft, designed to cut ground-handling time 50 to 75 per cent, increase safety, and provide greater convenience and economy, was announced this week by Dr. R. T. Goodwin, manager of the central aviation department of Shell Oil Co., Inc.

Goodwin said the new method will deliver fuel to tanks at a rate of 250 gal. per minute at such low pressures that no undue strain is placed on wing structures. There is no spillage, he said, since fuel remaining in the hose is withdrawn into the truck after fueling is completed.

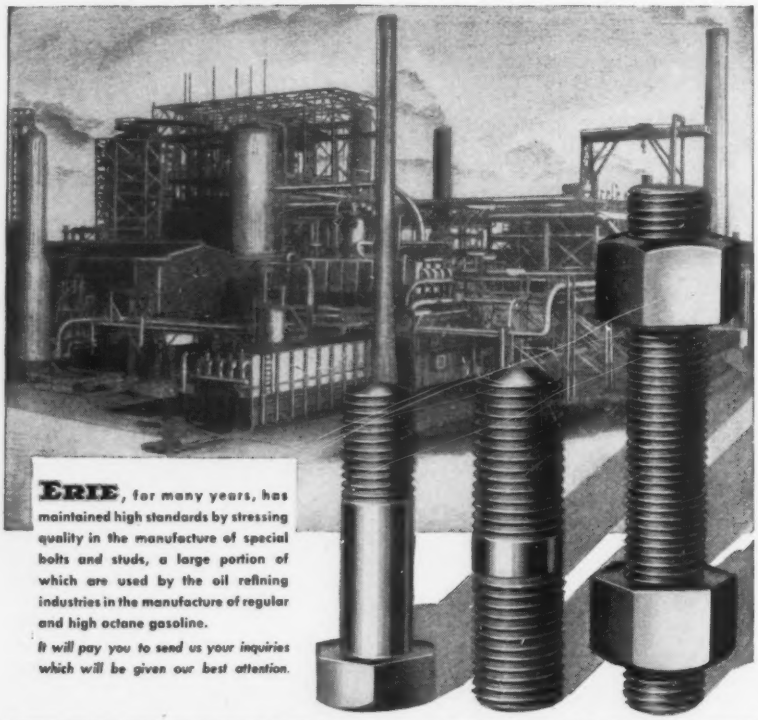
Report Describes Use of Asphalt With Concrete

WASHINGTON. — The addition of about 3 per cent of asphalt emulsion to standard concrete flooring mixtures greatly increased the shock-absorbing qualities of the finished concrete without noticeably decreasing its strength or durability, according to a report by the Office of Technical Services, Department of Commerce.

The report, which summarizes research done under contract with the Office of Production Research and Development of the War Production Board, discusses the unsuitability of asphalt alone as a binder and analyzes various cement-bitumen formula in terms of strength, resiliency, costs, and heat conductivity.

Dr. F. O. Anderegg, consulting specialist on building materials to the John B. Pierce Foundation, a housing-research organization, originated the project and conducted the experiments analyzed in the 28-page report.

The first section presents the results of experiments with various bitumens and bitumes composites used in an effort to stabilize specially se-



ERIE, for many years, has maintained high standards by stressing quality in the manufacture of special bolts and studs, a large portion of which are used by the oil refining industries in the manufacture of regular and high octane gasoline.

It will pay you to send us your inquiries which will be given our best attention.

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lected and graded aggregates. The bitumen alone did not produce satisfactory results.

However, when experiments with cement-bitumen mixes were undertaken, it was found that excellent results were obtained. Costs are likely to be lower for the concrete-bitumen mix than for concrete alone, Dr. Anderegg said, since the new type of flooring can be finished by power float. Preliminary tests show that the new cement-asphalt floor has adequate strength properties, including compression, abrasion, and indentation resistance. In addition, it has a somewhat lower heat conductivity than standard concrete floor.

Another report now on sale by the Office of Technical Services describes raw materials and equipment used in Germany in making paints, varnishes, and lacquers. The microfilmed documents, all but one in German, discuss atephen, desmodur, desmophen, and a plastic paint known as vinylite.

Tachometer Described In Government Report

WASHINGTON.—A simple electric tachometer which will record machinery shaft speeds from 300 to 6,000 r.p.m. is described in a report now on sale by the Office of Technical Services, Department of Commerce.

The report was written by Chester B. Cunningham of the U. S. Naval Research Laboratory. The tachometer was developed at the laboratory to replace a mechanical fly-ball tachometer. The newly developed electric tachometer had given 8 months of satisfactory service at the time the report was written, according to the department's announcement.

Monsanto Arranges Funds for Expansion

NEW YORK.—Sale to five insurance companies of $30,000,000 of 25-year debentures was announced last week by Monsanto Chemical Co. Monsanto officials said about $10,000,000 of the amount will be used in the purchase of the styrene plant and other facilities built for the government by Monsanto at Texas City, Tex., in the synthetic-rubber program. The remainder will finance expansion of the firm in other fields.

WAA Announces Sale of Synthetic Rubber Plant

WASHINGTON.—The second synthetic-rubber plant to be declared surplus by the Government was announced for sale last week by War Assets Administration.

It is the $43,00,000 plant operated in Louisville, Ky., by E. I. du Pont de Nemours & Co. The plant has a rated capacity of 40,000 long tons of neoprene per year and includes 12 buildings on a 222-acre site. Included in the offer, WAA said, are all tanks, vessels, catalyst, monovinyl and chlorobutadiene-manufacturing processes as well as all necessary end-product production facilities.

Shell Sales Offices Moved

HOUSTON.—Sales offices of Shell Chemical Corp. have been moved from the Deer Park plant to new quarters in the Shell Building at Texas Avenue and Fannin Street. E. R. Scogin, who joined Shell in January 1946, is district sales manager.

Safety Data Available

WASHINGTON.—The Manufacturing Chemists Association has announced the publication of Chemical-Safety Data Sheet SD-6 on paraformaldehyde; the sixth in the series of chemical-product safety manuals being prepared by the organization. Designed for supervisory staffs and management, the manuals concisely present essential information for the safe handling and use of chemical products. Copies are available for 15 cents from the association, 608 Woodward Building, Washington 5.

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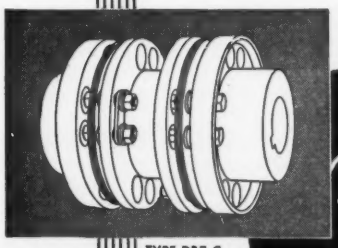

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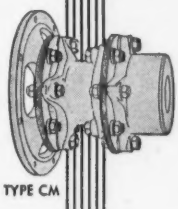

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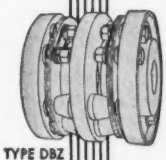

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THOMAS Flexible COUPLINGS provide for Angular and Parallel Misalignment as well as Free End Float . . . and Eliminate BACKLASH, FRICTION, WEAR and CROSS-PULL
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The Thomas All-Metal Coupling does not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.

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NATURAL GAS

FPC Lists 4,465 Miles Gas Pipe Line Approved

WASHINGTON.—Ninety certificates of public convenience and necessity issued by the Federal Power Commission between July 1, 1945, and September 30, 1946, approved construction of 4,465 miles of new gas pipe lines and new installation of 276,535 compressor horsepower.

Chairman Leland Olds said the new construction will provide 71 large cities and many smaller communities with an additional volume of at least 1,106,000,000 cu. ft. of natural gas daily.

"Normal pipe-line construction and extension was sharply curtailed by material shortages during the war period," Olds said, "with the result that facilities were not available to meet the great demand for natural gas which developed in the immediate postwar period."

Olds attributed the "unprecedented demand" for natural gas to the increasing availability of gas-fired house heating units and activity of the FPC in bringing about reductions in the wholesale rates of natural gas supplied by interstate pipe-line companies.

"The commission's records show that all applications for certificates which could affect the heating situation during the winter of 1946-47 have been acted upon, as well as a number of applications for construction and operation having a bearing upon the fuel-supply situation in the winter of 1947-48," Olds said. Many companies which have received FPC approval of expansion plans, he added, "have been meeting shortages of material and equipment that likely will cause extensive delays in completing projects."

The new construction, planned to take place in 18 states, will represent a total cost of $193,576,544, the FPC chairman said.

Projects approved by FPC during the 15-month period with an estimated cost of more than $5,000,000 each include:

Northern Natural Gas Co.: Five compressor stations and 266 miles of loop lines larger than 12-in., to cost $9,096,119.

Natural Gas Pipe Line Co. of America and Texoma Natural Gas Co.: 366 miles of 20-in. or larger loop lines, 46 miles of smaller capacity line, and four compressor stations, to cost $19,231,075.

El Paso Natural Gas Co.: Compressor units totaling 129,800 hp., 983 miles of line of 24 in. or larger, 112 miles of lateral lines, and other facilities, to cost $53,800,000. Designed to transport natural gas to the Arizona-California state line.

Southern California Gas Co. and Southern Counties Gas Co. of California: 214 miles of 30-in. line, compressor station totaling 10,000 hp., and other facilities to transport gas from the Arizona-California state line to Santa Fe Springs, Calif., to cost $16,225,000.

Hope Natural Gas Co.: 24 miles of 20-in. line, 119 miles of line greater than 12-in., compressor units of 3,000 hp., and other facilities, to cost $5,327,500.

Tennessee Gas & Transmission Co.: 400 miles of 26-in. loop line, 10 miles of 24-in. line, compressor stations totaling 44,000 hp., 20 miles of lateral lines, to cost $27,405,000.

United Gas Pipe Line Co.: 143 miles of 24-in. line, 4½ miles of 18-in. line and other facilities, to cost $7,231,221.

Panhandle Eastern Pipe Line Co.: 24 miles of 26-in. line, 50 miles of 18-in. line, compressor units totaling 20,000 hp., to cost $6,216,000.

Mississippi River Fuel Corp.: 279 miles of loop line, compressor station additions totaling 10,400 hp., and other facilities, to cost $11,574,000.

Move Toward Lower Rates of Return Seen

Possibility that a 5 per cent rate of return fixed by the Federal Power Commission for Safe Harbor Water Power Corp. might be "a first step in the agency's efforts to bring about a lower rate of return for all business under its jurisdiction," is expressed in a December issue of the I.N.G.A.A. News, publication of the Independent Natural Gas Association of America.

The publication termed "significant" FPC's action in allowing the company "a return on its net investment less a fixed annual charge for depreciation calculated by the 'straightline' method."

The publication pointed out that the rate of return of Safe Harbor, an electric utility, now is ½ per cent lower than that allowed by FPC for the Chicago District Electric Generating Corp. in 1939 and 1 per cent lower than the rate set in November 1945 in the case involving the Mississippi River Fuel Co. As in both of these cases, FPC ruled that Safe Harbor enjoys financial and operational advantages not available to public utilities in general and that these advantages justify a low rate of return.

Natural Gasoline

Continued Channel-Type Black Shortage Seen

BOSTON.—The United States will continue to have a shortage of carbon black made by the channel process for at least 6 months, O. J. Brown, general sales manager for Godfrey L. Cabot, Inc., declared here last week.

The channel process produces about 55 per cent of carbon black manufactured in this country. Brown indicated a possible reduction in the number of automobile tires being produced, saying tire manufacturers had been digging into their stocks throughout 1946. Carbon-black manufacturers, he said, have less than 1 week's supply on hand in warehouses. Brown said the average passenger-car tire requires about 4 lb. of carbon black. Natural-rubber tires, he said, require a greater amount of channel-type carbon black than do synthetic tires.

Robinson Named Head of Butane-Propane Association

John M. Robinson, of Butane Gas Co., Woodworth, La., has been elected president of the National Butane-Propane Association to succeed J. Richard Kerkamp, who is retiring. Robinson, a member of the board of directors, was elected at a recent meeting of the board and the executive committee in Chicago.

Joseph S. Fagan, of Mutual Liquid Gas & Equipment Co., Inglewood, Calif., was elected first vice president, and W. A. Moey, assistant secretary.

A.G.A. Safety Data in Use

NEW YORK.—The American Gas Association reports increasingly widespread use by company members of its "Foreman's Safety Messages." The service, sent at regular intervals, was resumed last September by the accident-prevention committee of the association which is headed by Howard T. Jayne, chairman. The entire series of messages has been reviewed by the committee which retained what was considered the most effective and modified others to bring them up-to-date.

Resolve: to make 1947 an outstanding year of drilling operations. To help you achieve that goal is our aim, so feel free to call on us to assist you with your mud problems. Our trained field personnel and modern laboratory are always at your disposal.

MAGNET COVE BARIUM CORPORATION

Houston, Texas **Malvern, Arkansas**

STATISTICS and T

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 21, 1946

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	28	14	0	*14	40,937	1,537	1,442	0	0	0	0	0	0	0	0	0	0
Pennsylvania	72	37	4	†31	112,823	3,863	3,941	0	0	0	0	0	0	0	0	0	0
West Virginia	12	3	4	5	32,854	732	789	0	0	0	0	0	0	0	0	0	0
Ohio	28	9	13	6	76,026	1,249	964	0	0	0	1	1	4	0	16	43	63
Indiana	15	7	0	8	33,537	374	193	0	0	0	0	0	6	0	0	20	26
Kentucky	13	8	1	4	17,708	469	566	0	0	0	0	0	7	0	0	37	44
Illinois	63	28	1	34	157,675	2,262	1,782	1	0	1	7	9	54	0	3	447	504
Michigan	18	4	4	10	39,080	798	749	1	0	0	7	8	23	0	10	253	286
Kansas	59	29	17	13	178,328	1,989	1,746	1	0	0	6	7	30	0	2	265	297
Neb., Mo., Iowa	0	0	0	0	0	19	29	0	0	0	0	0	0	0	0	14	14
Oklahoma	93	44	5	‡44	229,932	2,982	2,364	0	0	1	22	23	93	0	39	424	556
Texas	148	85	6	57	693,393	7,656	6,934	4	0	1	33	38	208	29	34	1,276	1,547
North Central	46	26	1	19	116,965	2,667	2,192	2	0	0	11	13	75	0	4	522	601
West	32	25	0	7	174,108	1,729	1,698	0	0	0	3	3	47	0	1	168	216
Panhandle	0	0	0	0	0	300	525	0	0	0	0	0	0	0	0	5	5
Eastern	7	3	1	3	32,924	675	386	0	0	0	0	0	45	22	13	237	317
Gulf Coast	42	25	2	15	300,969	1,698	1,631	1	0	1	8	10	21	5	6	120	152
Southwest	21	6	2	13	68,427	587	502	1	0	0	11	12	20	2	10	224	256
Louisiana	32	17	3	12	190,157	1,376	1,084	0	0	0	3	3	45	14	8	180	247
Northern	19	9	3	7	62,653	782	479	0	0	0	1	1	9	0	3	97	109
Southern	13	8	0	5	127,504	594	605	0	0	0	2	2	36	14	5	83	138
Arkansas	6	5	0	1	26,027	179	180	1	0	0	1	2	9	0	0	39	48
Mississippi	10	8	1	1	77,094	258	351	1	0	0	1	2	2	0	1	73	76
Southeastern States	0	0	0	0	0	43	58	0	0	0	0	0	1	0	0	35	36
Montana	4	3	1	0	7,246	308	309	0	0	0	0	0	10	0	4	32	46
Wyoming	5	5	0	0	26,972	167	223	0	0	0	0	0	13	0	3	34	50
Colorado-Utah	1	1	0	0	6,477	164	59	0	0	0	0	0	5	0	0	18	23
New Mexico	7	5	1	1	31,455	395	416	0	0	0	0	0	4	0	0	38	42
California	20	11	1	8	99,502	1,436	2,155	0	0	0	8	8	27	0	7	232	266
Total United States	634	323	62	249	2,077,223	28,256	26,334	9	0	3	89	101	541	43	127	3,460	4,171
Total previous week	614	295	71	248	2,119,300	27,622	25,919	10	2	4	104	118	532	43	124	3,371	4,070
Total Dec. 22, 1945	538	298	49	191	1,827,523			11	0	2	54	67	502	23	133	3,369	4,027

Service wells included: *14, †31, ‡2.

MARKET QUOTATIONS

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.17			
19-19.9	1.21			
20-20.9	1.24	$1.30		$1.17
21-21.9	1.28	1.32		1.19
22-22.9	1.32	1.34		1.21
23-23.9	1.35	1.36		1.23
24-24.9	1.39	1.38	$1.61	1.25
25-25.9	1.43	1.40	1.63	1.27
26-26.9	1.46	1.42	1.65	1.29
27-27.9	1.50	1.44	1.67	1.31
28-28.9	1.54	1.46	1.69	1.33
29-29.9	1.57	1.48	1.71	1.35
30-30.9	1.61	1.50	1.73	1.37
31-31.9		1.52	1.75	1.39
32-32.9		1.54	1.77	1.41
33-33.9		1.56	1.79	1.43
34-34.9		1.58	1.81	1.45
35-35.9		1.60	1.83	1.47
36-36.9		1.62	1.85	1.49
37-37.9		1.64	1.87	1.51
38-38.9		1.66	1.89	1.53
39-39.9		1.68	1.91	1.55
40 and above		1.70	1.93	1.57

*For crude from Daboval, El Campo, and Sandy Point. †Includes Lea County, New Mexico.

(Quotations shown here are f.o.b. plant in tank cars and in cents per gal. as of last Monday.

REFINERY GASOLINE

Octane (A.S.T.M.)	78-78½†	73-75
Mid-Continent*	7.375-7.625	6.750-7.000
Tex. Gulf Coast	7.250	6.500-6.750
New York Harbor	9-10.75	8-9.25
California		6.250-6.750

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades—	26-70	18-55
Oklahoma (Group 3)	5-5.125	6-6.15
N. Texas (f.o.b. plant)	4.500	5.400
N. Louisiana (f.o.b. plant)	4.750	5.700
California (averages)	5.500	6.250

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.70
Kettleman Hills, California*	1.69
Beauregard Parish	1.65
Illinois Basin	1.82
Pecos County, Texas (Yates)	1.40
Bradford, Pennsylvania	3.55
Eastern Ill., and Western Ind.	1.67

Note: Crude prices exclusive of subsidy.

A.P.I. REFINERY REPORT

Week ended December 14, 1946

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks Gasoline	Distillate	Residual
East Coast	733	19,012	22,030	9,938
Appalachian	159	3,310	642	564
Ill., Ind., Ky.	764	15,864	6,935	4,428
Okla., Kan., Mo.	378	8,784	3,153	1,310
Inland Texas	207	3,414	551	774
Tex. Gulf Cst.	1,135	13,709	11,234	7,383
La. Gulf Cst.	323	4,524	4,144	2,306
N. La., Ark.	54	1,749	550	128
Rocky Mtn.	141	1,931	488	642
California	791	16,381	12,420	28,626
Total 12-14-46	4,685	88,678	62,147	56,096
Total 12- 7-46	4,720	88,183	63,851	57,209
Total 12-15-45	4,535	89,834	40,988	42,276

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of crude*
December 14, 1946	226,966,000
December 7, 1946	225,419,000
December 15, 1945	219,518,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Dec. 21 crude oil	B. of M. Dec. demand	Dec. 14 crude oil
Alabama	1,150	1,200	1,150
Arkansas	80,150	76,000	79,950
California	876,500	845,000	876,000
Colorado	36,980	32,000	36,500
Eastern	67,800	64,200	61,500
Florida	270	200	200
Illinois	201,900	210,000	202,200
Indiana	18,400	19,000	19,100
Kansas	275,650	263,000	279,950
Kentucky	30,100	29,000	29,800
Louisiana	410,075	382,000	409,975
North Louisiana	99,750	.....	99,650
South Louisiana	310,325	.....	310,325
Michigan	42,010	46,000	48,605
Mississippi	85,100	60,000	81,850
Montana	23,490	24,000	24,590
Nebraska	700	800	700
New Mexico	102,500	98,000	102,500
Oklahoma	371,450	380,000	370,800
Texas	1,996,065	2,050,000	1,996,065
District 1 (Southwest)	18,850	.....	18,850
District 2 (Southwest)	134,775	.....	134,775
District 4 (Southwest)	208,800	.....	208,800
District 3 (Gulf Coast)	422,625	.....	422,625
District 5 (Eastern)	34,615	.....	34,615
District 6 (Eastern)	99,375	.....	99,375
East Texas field	316,000	.....	316,000
District 7C (West)	27,700	.....	27,700
District 8 (West)	499,725	.....	499,725
District 7B (W. Central)	34,500	.....	34,500
District 9 (N. Central)	118,000	.....	118,000
District 10 (Panhandle)	81,100	.....	81,100
Wyoming	102,960	96,000	103,580
Miscellaneous	.....	600	.....
Total United States	*4,723,250	4,677,000	4,725,015

Change from prev. week, down 1,765

Total production January 1-December 21 ..... †1,687,501,589 bbl.

Same period last year (crude, plus condensate) 1,659,566,825 bbl.

*Not incl. 23,965 bbl. condensate. †Incl. 8,524,515 bbl. condensate.

CRUDE-OIL STOCKS 226,966,000 bbl. as of December 14—up 1,547,000 bbl. One year ago 219,518,000 bbl.

GASOLINE STOCKS 88,678,000 bbl. as of December 14—up 495,000 bbl. One year ago 89,834,000 bbl.

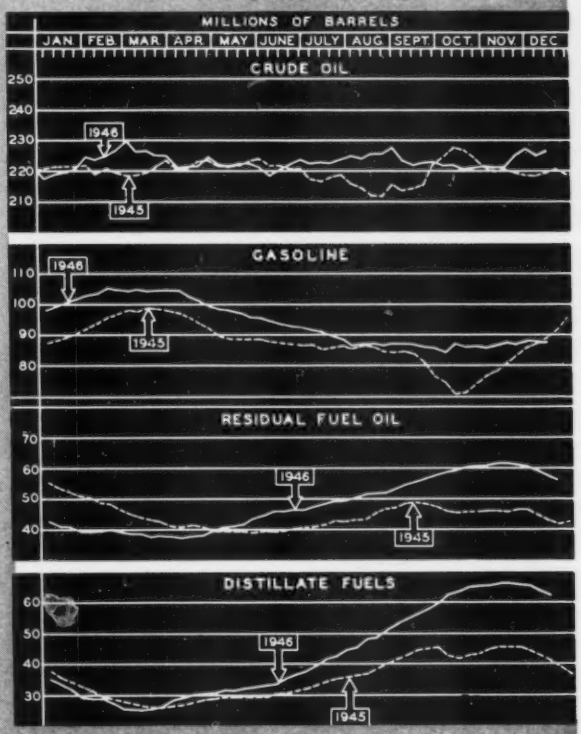
RESIDUAL FUEL-OIL STOCKS 56,096,000 bbl. as of December 14—down 1,113,000 bbl. One year ago 42,276,000 bbl.

GAS OIL AND DISTILLATE STOCKS 62,147,000 bbl. as of December 14—down 1,714,000 bbl. One year ago 40,988,000 bbl.

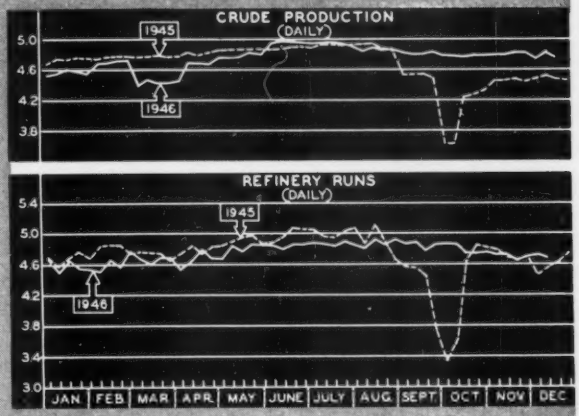
CRUDE-OIL PRODUCTION 4,723,250 bbl. as of December 21—down 1,765 bbl. One year ago 4,488,100 bbl.

REFINERY RUNS 4,685,000 bbl. daily week ended December 14—down 35,000 bbl. One year ago 4,535,000 bbl.

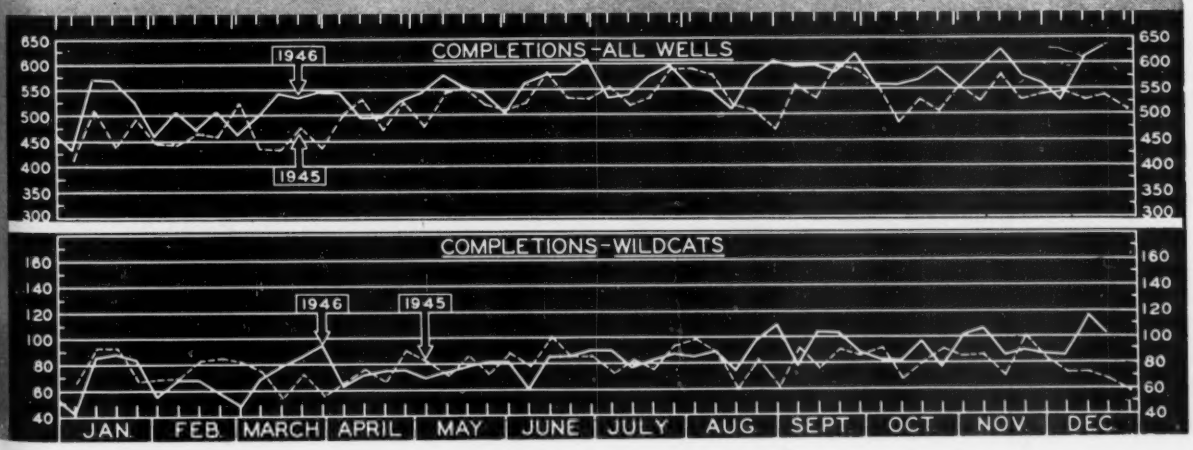
OIL STOCKS IN THE UNITED STATES



DAILY OPERATIONS



Solid line charts weekly completions, service wells in Eastern area included.



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Exploration and Drilling

Clay-Mineral Research

ONE of the hottest topics of interest in drilling and exploration circles is research into the properties of clay minerals. Drilling people see prospects of developing a cheap and easy method of whipping heaving-shale problems. Mud engineers see all kinds of possibilities for developing new methods of overcoming problems in maintaining the proper drilling-mud properties while drilling through various kinds of trouble-making formations.

Electric-logging people are interested in some of the developments about electric potentials in clay particles. Many people are firmly convinced that some of the problems of interpretation of electric logs will be clarified considerably, when a thorough understanding is reached about the changes that take place in the electrical properties of clay minerals when certain conditions result in chemical changes.

Production men, petroleum engineers, and production-department geologists are watching keenly for developments that will clarify the effects of drilling fluids and formation waters on clay minerals. There are plenty of sign posts that indicate that many a well failed to produce as it should because of completion practices that resulted in effects on the clay minerals in the producing sands which brought about a substantial reduction in effective permeability of the sand face, and perhaps to some distance back in the reservoir from the well bore.

Petroleum engineers are interested in what effects may have brought about changes in cores, so that the results of core analysis were not typical of the reservoir away from the well bore. Production men are interested in leads to things that may have been responsible for caving sands, and costly cleanout work, to say nothing of potentially lost production.

Exploration geologists are looking for clues to interpretation of regional sedimentary - deposition problems. Here may lie some of the answers as to why some structures in a producing region yield good oil fields, while others are barren. Also this line of attack may bring up some answers about what to expect in the step-out plays into the deeper parts of the various regional geological basins. The march of deep exploration out into the basins is one of the significant trends of recent years. It is an expensive venture at best, and anything that will throw more light on what to expect, and where to expect it, can be utilized to reduce the risk and therefore the cost of finding new fields.

KANSAS

Western Kansas May Get New Viola Lime Pool

KANSAS exploratory operations, which have been disappointing so far during the current year, appear to be paying off with a series of relatively important strikes during the closing days of 1946. Latest discovery reported is in Kingman County, western Kansas, where the Plains Exploration Co. is testing a possible pool-opener at its 1 Swander, SW SE SW 20-28s-9w. On a 28-minute drill-stem test of the Viola lime at 4,407-12 ft., the well cleaned into the pits with oil that tested 39.6°-gravity. Flow was estimated at the rate of 1,000 bbl. a day. The wildcat is located about 11 miles southeast of the Cunningham oil and gas field on a farmout from Phillips Petroleum Co. Contract calls for testing the Simpson and Arbuckle lime zones, and the well is drilling ahead toward these lower horizons at the present time.

After deepening 3 ft. to a total depth of 3,625 ft., Continental Oil Co. 1 Mortgage, SE NE NE 3-11-18w, Ellis County wildcat, swabbed 87 bbl. of oil per hour for 3 hours from a depth 1,000 ft. off bottom. Located 1½ miles west of the north edge of the Burnett pool in the northern part of the county, the wildcat had 2 800 ft. of oil in the hole within 3 hours after drilling in at a depth of 3,622 ft. The Lansing was topped at 3,300 ft., conglomerate at 3,592 ft. and the Arbuckle at 3,617 ft.

Continental Oil Co.'s Simpson sand discovery well in Barber County, the 1 Smith, NW NW NW 21-33s-12w, established an official potential of 1,405 bbl. of oil daily on the basis of an 8-hour test during the past week. In a 10-hour test the well flowed at the rate of 59 bbl. of oil per hour through a ¾-in. choke and the oil was accompanied by approximately 1,000,000 cu. ft. of gas. Gravity of the oil, coming from the Simpson at 4,849 ft., is 28.6°, corrected. This discovery is rated as the outstanding Kansas development of the year and further drilling is expected to get under way rapidly.

KANSAS SUCCESSFUL WILDCAT

Woodson County: G. A. Bisagno and Ruth Lane et al 1 S. Campbell, SE SE SE 19-26s-15e, pumped 30 bbl. of oil per day from Bartlesville sand at 1,423-53 ft., TD 1,529 ft.

KANSAS WILDCAT FAILURES

Butler County: Sid Johnson et al 1, SW SW SW 28-27s-5e, dry, TD 2,818 ft., Lansing-Kansas City 1,893 ft., Kansas City 2,215 ft., Mississippi lime 2,784 ft.

Greenwood County: Ward McGinnis 1 Ramsey, NE SW NE 20-26s-12e, dry, TD 1,169 ft., Kansas City 1,040 ft.

McPherson County: Barbara Oil 1 Lovett, SW SW NE 22-19s-1w, dry, TD 2,980 ft., Mississippi lime 2,930 ft.

Morton County: D. G. Hansen 1 E. M. Sullivan, NE NE SW 35-5s-21w, dry, TD 3,660 ft., Lansing-Kansas City 3,403 ft., Granite Wash 3,653 ft.

Phillips County: Stanolind Oil & Gas 1 F. Brenneke, SE SE SE 2-4s-19w, dry, TD 3,788 ft., Lansing-Kansas City 3,266 ft., Arbuckle 3,598 ft.

Saline County: Westgate-Greenland Oil 1 Baird, SW NW NW 19-13s-3w, dry, TD 3,886 ft., Mississippi lime 3,026 ft., Hunton 3,458 ft., Simpson dolomite 3,788 ft., Arbuckle 3,870 ft.

PERMIAN BASIN

Additional Acreage Added To New Andector Field

MIDLAND.—Additional acreage was added to the new Andector field last week at Plymouth Oil Co. 1-1 R. B. Cowden, Section 1, Block 45, T&P Survey, on the Andrews County side. A 2-hour drill-stem test at 7,287-7,399 ft. made a blow of air the first hour and a good blow of sweet gas the second. It recovered 150 ft. of oil-cut mud. On last report it was drilling ahead below 7,399 ft.

In Winkler County, Gulf Oil Corp. 99-E Keystone, in Section 10, Block B-3, PSL Survey, opened a new pay zone for the Keystone area at 5,050-66 ft. A drill-stem test at that depth had gas to the surface in 5 minutes, fluid in 27 minutes, and flowed 378 bbl. of oil in 10 hours. Gas-oil ratio was 839 to 1. On a previous test, at 5,031-41 ft., it flowed 505 bbl. of oil in 5 hours. Gravity was 41, and sediment was only 2 per cent. Location of the well is on the south side of the Keystone field and the new formation, while not definitely placed, is below the Holt but in the upper Clearfork zone of the Permian. It was said that operators may drill deeper to the Ellenburger before completing.

Early last week Humble Oil & Refining Co. 2 Sims, West Andrews County Ellenburger discovery, 3 miles north of the Nelson field discovery well, was running completion tests at 10,474-535 ft. after treating with 2,000 gal. of acid. A 24-hour potential of 704 bbl. of 42°-gravity oil was indicated through ¼-in. choke. Gas-oil ratio was 363 to 1.

WEST TEXAS WILDCAT FAILURES

Ector County: Plymouth Oil Co. 1 Headlee, Sec. 34, Blk. 41, T&P Sur., 10 mi. NE of Odessa, elev. 2,978 ft., dry, TD 5,010 ft., recovered core at 4,915-35 ft. indicating good porosity with slight stain and odor, Yates 3,260 ft., San Andres 4,900 ft.

Fisher County: American Liberty Oil Co.

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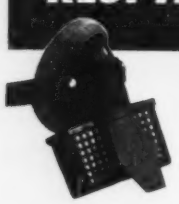

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1 W. A. Cross, Bastrop CSL Sur. 323, 2½ mi. S of Sylvester, elev. 1,849 ft., dry, TD 4,872 ft. in sand.

SOUTHEASTERN NEW MEXICO

HOBBS.—Sun Oil Co.'s Hobbs field test, the 1-B McKinley, 2-18s-28e, continued testing at total depth of 7,658 ft. In 5 hours it swabbed 16½ bbl. of fluid, cutting 1 per cent sediment. A retreatment with acid resulted in 22 bbl. of fluid in 3 hours, cutting 50 per cent oil and the balance water. Then in 24 hours it swabbed 142 bbl. of fluid, 90 per cent oil.

In Eddy County, Martin Yates, Jr. 1 Kaiser, 29-18s-27e, was shut down for orders at 3,660 ft. in lime. Harvey E. Yates 1 Yates-State, 32-18s-30e, was shut down for casing at 3,998 ft. in lime. Nash, Windfohr & Brown's wildcat in the Grayburg-Jackson area, 24-17s-30e, was drilling below 4,080 ft. in lime. A Lea County wildcat, Emperor Oil Co. 1 State, 32-16s-32e, was drilling below 4,033 ft. after bailing some 10 bbl. of oil a day in sand at 3,876-85 ft.

OKLAHOMA

Mechanical Difficulties Delay Major County Well

THE R. Olsen et al 1 Ott, W½ SW SE 4-21n-9w, Oklahoma's most closely watched wildcat, was forced to shut down at the close of the week due to mechanical difficulties experienced while tools were being pulled to take a drill-stem test. The delay is expected to be of short duration, however.

Located southeast of the one-well Ringwood pool, the 1 Ott made an estimated 12,000,000 to 15,000,000 cu. ft. of dry gas a day on a drill-stem test of the Wilcox sand zone at 7,918-8,103 ft. Crew drilled ahead a few feet and were to take a second test when the delay occurred. First Wilcox sand was topped at 7,923 ft., and the second sand was logged at 8,005 ft.

Extension of the Southwest Wayne field to the northwest or opening of a new pool in the McClain County sector was indicated at week's end by the results of an initial test at the Wood Oil et al 1 Henderson, SE NE NW 14-5n-2w. After casing had been perforated opposite the Hunton lime at 7,098-7,125 ft., the well blew an estimated 5,000,000 cu. ft. of gas and a spray of distillate. It was then shut in for further testing.

The 1 Henderson was originally drilled to 7,210 ft. by the Mid-Continent Petroleum Corp. and temporarily abandoned last October. Early this month, the well and lease were taken over by Charles M. Day of Blackwell, who made a deal with the Wood Oil Co. to retest and work over. Casing was run to the bottom of the hole and perforated opposite the Hunton for the first test. If this test proves inconclusive, the new operators will deepen to the Bromide zone for further testing.

Oklahoma's deepest drilling well, the Superior 51-11 Weller, a Caddo County wildcat in NW NW NE 11-8n-12w, may soon overtake the California record holder. California's deepest well, which passed the world depth record about 2 weeks ago, is now being delayed by a fishing job at a total depth of 16,669 ft. The Superior is currently drilling below 16,264 ft. and has encountered no delays since spudding.

OKLAHOMA SUCCESSFUL WILDCAT

Okfuskee County: Sunray 1 Sam, NE NE SW 10-10n-9e, produced 6,500,000 cu. ft. of gas per day from Gilcrease at 3,056-69 ft., Bartlesville 2,350 ft., TD 3,312 ft.

OKLAHOMA WILDCAT FAILURES

Beckham County: Four States Oil et al 1 E. L. Martin, NW NW SW 32-8n-24w, dry, TD 2,203 ft., anhydrite 1,565 ft.

with a show of gas, Granite Wash 2,015 ft. with a show of oil.

Cotton County: Wayne McCormick et al 1 Nelson, SW SW NW NW 1-5s-12w, dry, TD 1,855 ft., sand 1,842-55 ft.

Nixon Petroleum 1 Kemp, SE NW SW 15-5s-12w, dry, TD 2,417 ft., Canyon lime 2,414 ft.

Akin & Dimock et al 1 Rogers, SW SE NW 19-2s-12w, dry, TD 2,527 ft., conglomerate sand 1,175-82 ft.

Sam Harmon et al 1 McCluckey, NE NE SE SE 32-4s-11w, dry, TD 2,010 ft.

A. R. Dillard 2 Enright, NW NW NW SW 4-3s-11w, dry, TD 1,690 ft., sand 1,651-53 ft.

Bridwell Oil 1 Cofier, NE NE NE SW 5-3s-11w, dry, TD 2,319 ft., Megargle 2,045 ft.

Wilcox Oil 1 Virginia, NW SE SW 13-3s-11w, dry, TD 2,172 ft., sand 1,365-75 ft.

Hastings & Knight 1 Henderson, SE SE NE SE 34-3s-11w, dry, TD 1,802 ft., sand 1,478-85 ft. with a show of oil.

H. W. Zweig et al 1 Thornton, NE NE SW 13-3s-13w, dry, TD 2,505 ft., Megargle 2,462 ft.

Falcon Seaboard 1 Tyler, NE NE NE SW 26-3s-11w, dry, TD 1,628 ft., sand 1,266-81 ft. and 1,515-41 ft.

Creek County: L. E. Reames 1-A Abraham, NW NW SW 30-14n-9e, dry, TD 2,821 ft., Lower Bartlesville 2,756 ft.

Garvin County: Big Chief Drilling 1 Blackwood, NE NW SW 6-4n-1w, dry, TD 6,503 ft., Bromide dense 6,145 ft.

Kiowa County: Cities Service 1 McNutt "A," SE SW NW 26-7n-17w, dry, TD 1,190 ft., conglomerate sand 652-60 ft. with a show of oil, lime 1,045-55 ft. with a show of oil.

Logan County: Atlantic & Magnolia 1 Wolf "B," C NE NW 32-18n-3w, dry, TD 4,745 ft., Lower Oread 3,510 ft., Layton 4,710 ft.

Noble County: Shell Oil Co. 1 Kirk, SW SE NE 20-23n-2w, dry, TD 4,555 ft., Layton 3,508 ft., 1st Wilcox 4,435 ft., 2nd Wilcox 4,504 ft.

Osage County: Wilcox 1 Mullen, NE SE SE 28-25n-6e, dry, TD 2,972 ft., Mississippi lime 2,898 ft.

Ohio Oil Co. 1 Barker, SE SE NE 2-23n-8e, dry, TD 2,708 ft., Prue 1,970-85 ft. with good show of gas, Mississippi lime 2,296 ft., Arbuckle 2,645 ft.

Stephens County: Guy Fitzgerald 1 Oliphant, SW SW SW NE 2-3s-7w, dry, TD 2,435 ft., sand and sandy shale 1,941-62 ft.

R. L. Fisher 1 Johnson, NW NW NW SW 22-2s-9w, dry, TD 2,510 ft., no tops reported.

Tillman County: S. D. Johnson 1 Strecker, SE SE SE NW 21-1s-14w, dry, TD 1,360 ft., hard sandy lime 1,107-85 ft.

Yandell & Rogers 1 Clapp, NE NE NW 12-2s-16w, dry, TD 2,020 ft., lime 1,000-980 ft.

EASTERN TEXAS

Smith County Discovery Completed for 283 Bbl.

DALLAS.—Delta Drilling Co.'s northwest Smith County discovery, the 1 Boynton, 1 mile east of Mount Sylvan, was ready for completion last week, and on potential tests flowed 283.37 bbl. of 33.3°-gravity oil in 24 hours through ¼-in. choke on tubing. Tubing pressure was 175 lb. and casing pressure 210 lb. Gas-oil ratio was 158 to 1. Production is from casing perforations at 7,512-28 ft. Paluxy pay sand was at 7,516-27 ft., total depth. Electric log tops, on an elevation of 528 ft., were: Pecan 3,280 ft., Austin 4,600-4,835 ft., Woodbine 5,165 ft., Comanchean 6,116 ft., Main Street 6,262 ft., and top of the Paluxy 7,469 ft.

Interest has picked up in the area and

additional exploration is expected, at any rate by the majors supporting the 1 Boynton, which include Magnolia, Phillips, Stanolind, Humble and some independents. Those companies with holdings in the vicinity are expected to announce drilling plans soon.

Other East Texas exploration tests were drilling ahead on last report. In Franklin County, Humble Oil & Refining Co. 1 Jaggears, a Smackover lime test, was below 7,293 ft. with no shows. In Cherokee County, Standard Oil Co. of Texas 1 New Birmingham, 2½ miles northwest of Maydelle, was below 10,015 ft. On an elevation of 478 ft., it had the James line at 9,195 ft., Pettit at 9,250 ft., and the Travis Peak at 9,504 ft.

N. CENTRAL TEXAS

Montague County Discovery Pumps 82 Bbl. in 6 Hours

WICHITA FALLS.—Eason Oil Co. 1 Temple Yarbrough, a wildcat in the F. J. Bellow Survey, 4 miles north of St. Jo which has been testing for the past few weeks, pumped 82 bbl. of 39.6°-gravity oil in 6 hours, for an estimated completion potential of 328 bbl. of oil. It produces from a broken sand at 4,045-4,101 ft. and 4,104-22 ft., and is making only 2 per cent water. Electric log indicated water in the sand at 4,101½-04 ft. Production zone is thought to be the Strawn sand.

In Clay County, 4 miles southwest of Vashti, Continental Oil Co. 1 Roscoe Scott, Section 3,239, TE&L Survey, swabbed 49 bbl. of oil and 7 bbl. of acid water in 14 hours. It is in the Ellenburger at 6,515 ft., total depth. Earlier it swabbed 98 bbl. of oil and some acid water in 24 hours. On last report it was shut in and had built up casing pressure to 605 lb.

A new exploratory test for western Grayson County was announced by Seitz, Comegys & Seitz at its 1 G. F. Jamison, located 330 ft. from the south line and approximately 2,450 ft. from the west line of the Asa Hartsfield Survey, Abstract 491, and 2½ miles south of Whitesboro. It will test a limestone found near 5,200 ft. in a dry hole drilled by Sinclair Prairie Oil Co. ¾ mile to the west. Sinclair's test was carried to 6,316 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCATS

Archer County: Staley Oil Co. 2 Veida Powell, J. M. Armstrong Sur., 2½ mi. SE of Archer City, pumped 9.5 bbl. of 37°-gravity oil, sand 935-39 ft., TD 939 ft., elev. 986 ft.

Montague County: Eason Oil Co. 1 Temple Yarbrough, F. J. Bellows Sur., 4 mi. N of St. Jo, elev. 1,173 ft., flowed 82 bbl. 39.9°-gravity oil in 6 hours, sand 4,054-4,104 ft., TD 4,104 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: BOM Oil Co. et al 2 Coff Conner, J. W. Harris Subd., 3 mi. NW of Archer City, dry, TD 1,479 ft. in shale.

Harvey Drilling Co. 1 Abercrombie & Taylor, S. Abercrombie Sur., Abst. 752, 2½ mi. SW of Archer City, dry, TD 1,450 ft. in sand and shale.

Harvey Drilling Co. 1 C. L. Abercrombie, J. W. Harris Subd., Blk. 157, 2½ mi. SW of Archer City, elev. 1,004 ft., dry, TD 1,330 ft., Gunsight lime 1,224 ft.

McCurdy Bros. 1 Taber, Blk. 7, Dallas County School Land, 13 mi. W of Archer City, elev. 1,127 ft., dry, TD 1,536 ft. in broken sand.

Denton County: McCurdy Bros. 1 W. C. Kimbrough, BBB&C Sur., Abst. 198, 1 mi. NW of Bolivar, dry, TD 2,055 ft.

Montague County: Continental Oil Co. 1 T. R. Copeland, N. Kimbro Sur., 4 mi. NE of Stoneburg, elev. 884 ft., dry, TD 6,836 ft., Simpson 6,460 ft., limestone 6,712 ft.

Wilbarger County: National Associated Petroleum Co. 1 M. H. Lewis, Sec. 10, H&TC Sur., 3 mi. SW of Lockett, dry, TD 5,005 ft., no tops reported.

Trout-Hanson Producing Co. 1 Ernest Streit, Sec. 7, H&TC Sur., 8 mi. S and 8 mi. W of Vernon, dry, TD 3,503 ft. in shale.

WEST CENTRAL TEXAS WILDCAT FAILURES

McCulloch County: Bell Construction Co. 1 City of Melvin, A. W. Flick Sur. 1371, in Melvin Townsite, dry, TD 2,957 ft., Ellenburger 2,690 ft., Hickory sand 2,890 ft.

Guffey Drilling Co. 1 G. T. Gattis, Sec. 153, TE&L Sur., 10 mi. N of Brady, dry, dry, TD 1,026 ft. in lime.

Callahan County: Woodley Petroleum Co. et al 1 Mable George "A," 5 mi. E of Baird, elev. 1,586 ft., dry, TD 4,202 ft., Palo Pinto 2,133 ft., Caddo 3,411 ft., Mississippi 4,108 ft., Ellenburger 4,155 ft., sand with show of gas 3,860-70 ft., DST 4,108-16 ft. indicated 2,000,000 ft. gas, 1,700 lb. BHP.

SOUTH LOUISIANA

New Oil Field Indicated In Vermilion Parish

NEW ORLEANS.—Humble Oil & Refining Co. 1 Alfred Ray Romaine et al, 25-12s-1e, in Kaplan area of Vermilion Parish, recovered oil on a test indicating

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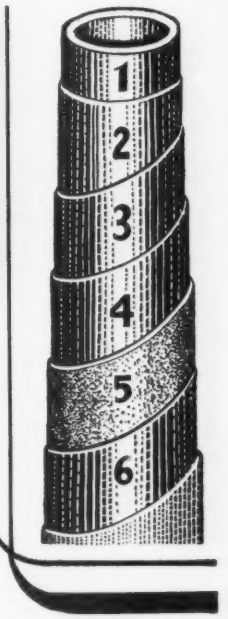

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MIAMI 36 · SAN FRANCISCO 10 · LOS ANGELES 1

a new oil field opener. On a test through 30 perforations at 11,065-71 ft. it flowed 102 bbl. of oil at a daily rate with a like amount of salt water. On a previous test at 11,769-75 ft. it recovered 100 per cent salt water. Operators will kill the well and make a new test. Total depth is 12,482 ft., and the 5½-in. casing is cemented to 11,876 ft.

Barnsdall Oil Co. is making a series of bottom-hole pressure tests in its Longville field discovery of Beauregard Parish. Its 1 Long Bell Lumber Co., 1-6s-10w, brought in new oil production from the Cockfield sands through perforations at 8,236-53 ft. No final completion gage has been made, but a gage reported to have been made gave a rated flow of 135 bbl. of 49°-gravity pipe-line oil daily through a 9/64-in. choke with 1,500 lb. flowing pressure on the tubing and a gas ratio of 1,422. Operators are expected to make a new gage.

There were 13 new locations reported this week with 2 being wildcats, 1 each in Jefferson Davis and Vermilion parishes. Eight development oil wells were completed. Five dry holes, three in proven areas and two exploratory, were reported, the dry wildcats located one each in Plaquemines and St. Mary parishes. Evangeline Parish received the greatest activity with five completions, three of which are in the Mamou pool.

SOUTH LOUISIANA WILDCAT FAILURES

Plaquemines Parish: Texas Co. 19 State-Delta Duck Club, 4-21s-20e, 1½ mi. SE of nearest production Delta Duck Club, dry, TD 9,806 ft.

St. Mary Parish: Amerada Pet. Corp. 1 Habert, 12-14s-9e, west of Charenton field, dry, TD 7,053 ft.

TEXAS GULF COAST

New Gas-Condensate Area Opened in Harris County

HOUSTON.—A new gas-condensate producing area has been opened in Harris County by Eli Marks at 1 A. B. Cohn Estate, in Meredith Duncan Survey. The initial test was made from open hole below the 5½-in. casing at 9,087-93 ft. where it flowed an ungaged amount of high-gravity oil, with 3,275 lb. flowing pressure on the tubing. Operators reported the well had a high gas-oil ratio and that plans were to squeeze the section and reperforate aroung 9,080-85 ft. for new test in hopes of reducing the ratio.

Ralph Johnston et al opened a new oil pool in the Tide Haven area of Matagorda County when their 1 F. Surkamp, in Josiah Tilley League, came in flowing at the estimated rate of 5 to 6 bbl. of 47°-gravity oil per hour through a ⅛-in. choke, from perforations at 8,531-34 ft. Due to a high ratio operators squeezed perforations and will reperforate at 8,533-36 ft. in an effort to lower the ratio. This test is on a farmout from the Ohio Oil Co., which drilled to 10,055 ft. before turning over to the new operators.

The 18 new locations reported this week included 1 wildcat in Brazoria County. The completions included 11 development oil wells, 1 gas discovery in Wharton County, and 7 dry holes, 3 being wildcats, in Liberty, Montgomery and San Jacinto counties

UPPER GULF COAST SUCCESSFUL WILDCAT

Wharton County: New gas pool—Floyd L. Karsten 1 J. L. Reitz, ET RR Sur., 1 mi. NW of South El Campo field and 1¾ mi. NE of Daboval field, TD 7,200 ft., perf. 6,936-42 ft., PT 3,579,000 cu. ft. gas per day through ¼-in. choke, dry gas, no water.

UPPER GULF COAST WILDCAT FAILURES

Liberty County: General Crude Oil Co. 2

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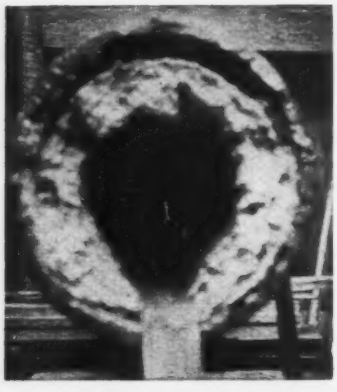

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Cu. in. Displ.	23	38.2	38.5	41.3
Hp. Range	4-6	5-7	6-8.5	7-9
Weight	130 lbs.	170 lbs.	175 lbs.	180 lbs.

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Phoenix Dev. Co., in J. Devore League, dry, TD 9,669 ft.

Montgomery County: Superior Oil Co. 1 Harry Brown, in William Hillhouse Sur., 2½ mi. SW of Magnolia townsite, dry, TD 11,347 ft.

San Jacinto County: Roxie Wright et al 1 H. L. Combs and Foster Lbr. Co., in Samuel Lust Sur., in West Mercy area, dry, TD 8,505 ft.

SOUTHWEST TEXAS

New Pay Zone Discovered In East Alta Mesa Field

CORPUS CHRISTI.—A new pay zone for the East Alta Mesa field in Brooks County, has been opened by Standard Oil Co. of Texas 6 B. G. de Garcia, Lease 1, in the La Encantada grant. On a drill-stem test open 24 hours, through ¼-in. chokes top and bottom, the well flowed 52 bbl. of condensate and 2,310,000 cu. ft. of gas per day, with 2,100 lb. tubing pressure. Test was made through perforations at 6,246-58 ft. and 6,262-68 ft. Total depth is 6,740 ft., with 7-in. casing at 6,451 ft.

The La Reforma field in northeastern Starr County has been extended 1 mile northwest by Sun Oil Co. 1-A C. V. de Lopez et al. It was completed as a gas well making approximately 1,160,000 cu. ft. of gas per day through perforations at 6,010-20 ft. in the top of a gas sand logged at 6,010-33 ft. Other tests below at 6,050-63 ft. and 6,072-88 ft. had only slight shows of oil and gas; and test at 6,089-98 ft. showed salt water. The 5½-in. casing was set at 6,138 ft. for the completion.

Of the 39 new locations this week 13 are wildcats located 2 each in Starr, Webb and Zavala, and 1 each in Atascosa, Caldwell, Frio, Kleberg, San Patricio, Williamson and Zapata counties. There were 2 successful exploratory tests 1 each in Live Oak and Starr counties while 16 were dry, 3 each in Medina and Zapata, 2 in Duval, and 1 each in Bee, Bexar, Karnes, McMullen, Nueces, Refugio, Webb, and Willacy counties. Twenty development oil wells were completed.

SOUTHWEST TEXAS SUCCESSFUL WILDCATS

Live Oak County: New oil pool, Schwartz—Henshaw Bros. and E. H. Smith 1 H. N. Schwartz et al, in John McMullen Sur., 6 mi. W of Mathis, 2 mi. NE of Lucas gas field, TD 4,495 ft., PT 46 bbl. oil per day through a ⅛-in. choke, gravity 23°, no water, top pay 4,011 ft., perf. 4,016-19 ft.

Starr County: New oil discovery—Daubert-Achning 1 M. Villareal, in Santa Cruz grant, 6,600 ft. SE of Kelsey field, top pay 5,954 ft., perf. 5,961-67 ft., PT 152 bbl. oil per day through a ⅛-in. choke, gravity 41°, no water.

SOUTHWEST TEXAS WILDCAT FAILURES

Bee County: Southern Minerals Corp. 1 B. F. Beasly, in Wm. Allen Sur., 1 mi. NW of Tynan, dry, TD 4,950 ft.

Bexar County: J. A. Caldwell 1 Maude Cousins, in J. H. Lucas Sur., 9 mi. SE of San Antonio, dry, TD 530 ft.

Duval County: Edwin B. Cox and Jake L. Hamon 1 D. C. Chapa, AB&M Sur. 500, 12 mi. NW of Benavides, dry, TD 2,452 ft.

The Sharples Corp. 1 Damillo Palacios, in San Andres grant, 2⅛ mi. SE of East Longhorn field, dry, TD 6,450 ft.

Karnes County: Magnolia 1 Dallas Husky, in. Thos. J. Devine subd. of Carlos Martinez 15-lge. grant, dry, TD 7,610 ft.

Medina County: C. G. Bigby 1 Mrs. L. S. Bader, in Medina Co. School Land, 4 mi. S of Dunlay, dry, TD 1,050 ft.

Conway Dev. Co. 1 Mary Wynne, in J.

Campbell Sur. 24, 8 mi. SE of Hondo, dry, TD 210 ft.

Rio Seco Oil Co., Inc. 1 James Amberson, in G. Van Norman Sur. 436, 3¾ mi. N of D'Hanis, dry, TD 800 ft.

McMullen County: Briam Jones 1 E. R. Hagist et al, BS&F Sur. 121, 1½ mi. SW of San Jose field, dry, TD 2,210 ft.

Nueces County: Renwar Oil Corp. 1 Frank Cech, Laureles farm tracts, 10 mi. S of Corpus Christi, dry, TD 10,765 ft.

Refugio County: The Sharples Corp. 1 Mrs. Audrey Baumgartner, in J. J. de la Garza and Jose Vidauri Sur., Abst. 66, 2½ mi. NE of Greta field, dry, TD 6,525 ft.

Webb County: Texas Co. 1 A. E. Gates, CCSD&RGNG Sur. 63, 15½ mi. SW of Freer, dry, TD 2,520 ft.

Willacy County: Magnolia & Abercrombie 1 Yturria Cattle Co., in Lot 56 of Cockburn-Hargrove subd. of San Juan de Carricitos grant, 6½ mi. NW of Raymondville, dry, TD 10,298 ft.

Zapata County: Sawnie Robertson 1 Serapie Vela Hrs., in Rafael Vela Porcion 26, 12 mi. E of Zapata, dry, TD 2,404 ft.

Wm. H. Spice, Jr. 1 Albert Martin, Tr., in Antonio Zapata (Villa) grant, 2 mi. SE of Comitas field, dry, TD 2,072 ft.

Thad O. Day 1 Joe Dodier, in El Socarro grant, 12 mi. NE of Zapata, dry, TD 2,508 ft.

ROCKY MOUNTAIN

Rangely Well Flows 120 Bbl. of Oil an Hour

DENVER.—The Rangely field in western Colorado, in which most of the Weber sand wells are completed for 250 to 500 bbl. per day, usually through a ¼-in. choke, has upset previous calculations with a gusher that flowed at a rate better than 3,000 bbl. a day. It is still testing and is not yet listed as a completion. The well is 4-32 McLaughlin, C SE NE 32-2n-102w, a joint operation of the Idaho Refining Co., Sharples Corp., and Wasatch Oil Refining Co. It is located only 1½ miles southeast of the California Co. discovery well which was completed for 300 bbl. in 1933, and 2½ miles west and north of the farthest outpost on the southeast. The well was drilled to a total depth of 5,787 ft., only 180 ft. into the Weber and 150 ft. below the casing point. This compares with a customary penetration of 600 to 700 ft., but at that depth it had several blowouts and it was decided not to risk drilling deeper into the pay. After getting it under control a 12-hour test was made through the tubing in which it flowed 120 bbl. an hour, holding consistently at that figure throughout the period. There were no abnormal sand conditions or elevation status to explain its performance, and the best guess of the geologists is that it hit a fault. Same operators' 8-33 McLaughlin, one location to the east, was completed 2 months ago 502 ft. in the Weber, and flowed 462 bbl. in 24 hours through a 24/64-in. choke with casing pressure of 840 psi. and tubing pressure of 300 psi. after being shot. Same operators' 3-32 McLaughlin, one location to the west, stopped 350 ft. in the Weber and flowed 530 bbl. per day through ¼-in. choke. It also showed heavy pressure, and stopped drilling before making the customary penetration.

A subsurface map of the field recently published by the U. S. Geological Survey shows a southwest-northeast fault through Sections 5, 32, 33, 28 and 27. It is explained in the text, however, that the fault is hypothetical as it is suggested only by the electric log of 2 McLaughlin. A parallel hypothetical fault also is mapped ½ mile to the west. More light on the significance of the showing is expected following a detail study of the electric logs.

Deep sand failure at Steamboat Butte.—

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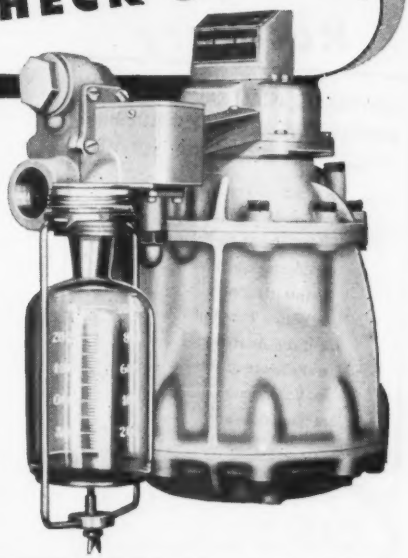

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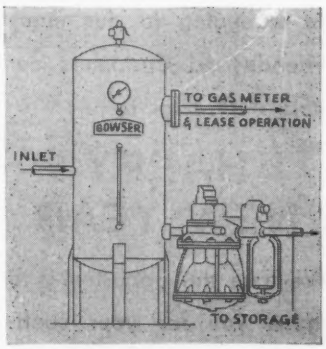

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TULSA OKLAHOMA

British-American Oil Producing Co. 6-E Tribal, NW NE NW 5-3n-1w, Steamboat Butte field, Fremont County, Wyoming, a test to the Amsden and Madison failed to find commercial production in those horizons. The Amsden was topped at 7,233 ft., and showed for estimated 3,000,000 cu. ft. of noninflammable gas. The Madison, top at 7,368 ft., made water. Hole was plugged back from 8,000 ft., total depth, to the Tensleep, topped at 6,736 ft., and completed for an estimated 406 bbl. per day. The field, discoverd in 1943, has found production in the Frontier, Lakota, Nuggett and Tensleep, and has produced close to 4,000,000 bbl. of oil to date.

Eastern Colorado wildcat.—Santa Fe Corp. and others 1 Union Pacific-JOD Ranch, SW SE NW 25-13s-52w, Arroya District, Lincoln County, Colorado, was drilled to 3,395 ft., and suspended operations until spring when it may be continued to sands in the Pennsylvanian. It had a show of gas in the Frontier, topped at 1,951 ft. Other tops were Dakota, 2,345; Morrison, 2,695, and Day Creek, 3,330 ft.

WYOMING WILDCAT FAILURE

Steamboat Butte, Fremont County: British-American Oil Prod. Co. 6-2 Tribal, NW NE NW 5-3n-1w, TD 8,000 ft., top Tensleep 6,736 ft., Amsden 7,233 ft., Madison 7,368 ft., water in Madison, noninflammable gas in Amsden, PB to Tensleep and completed as a development well for est. 406 bbl. per day.

ILLINOIS

Aux Vases Pool Indicated In Franklin County

MATTOON.—A new oil pool was indicated for Franklin County last week when the Sohio Petroleum Co. 1 L. Bossermman, NE SE SE 5-5s-3e, set pipe on good oil saturation encountered in the Aux Vases sand at 2,834-38 ft. A 1-hour drill-stem test of the Aux Vases at 2,834-41 ft. resulted in the recovery of gas in 50 minutes, 1,060 ft. of clean oil, 40 ft. of oil-cut mud and 30 ft. of drilling fluid. Bottom-hole pressure was recorded at 1,050 psi. The 1 Bossermann is located approximately 1 mile west of the Ewing pool which produces from the McClosky lime.

A new pool is also in prospect 3 miles southwest of the Kenner pool in Clay County where the National Associated Petroleum Co. 1 N. O. Golden, SW NE SW 17-3n-6e, is cleaning out and testing in the Benoist sand. Saturation was encountered in the Benoist at 2,758-63 ft., total depth, and the well swabbed at the rate of 2 bbl. of oil an hour natural from this formation while cleaning out.

Sam Malis last week finished what is apparently the best well yet completed in the Lancaster pool of Wabash County. The 2 Schnitz, NE SW SE 6-1n-13w, came in for an initial potential of 500 bbl. of oil a day flowing following an acid treatment of 2,000 gal. in the Levias lime at 2,788-98 ft. Good saturation was also found in the Rosiclare lime at 2,821-25 ft., but this has not been tested.

ILLINOIS SUCCESSFUL WILDCATS

Morgan County: L. M. Ladet 1 McMahan, NE NE NW 22-13n-8w, IP 1,270,000 cu. ft. gas, 2,000 gal. acid, Devonian 980 ft., TD 1,543 ft., PB 1,025 ft.

Shelby County: W. R. Britton 1 Kensil Heirs, NE NE SE 21-11n-4e, pumped 2 bbl. oil and 3 bbl. water, 5-qt. shot 1,835-45 ft., Aux Vases 1,830-40 ft., 1,842-51 ft., TD 1,855 ft.

ILLINOIS WILDCAT FAILURES

Clay County: National Associated Petroleum Corp. 1 Helm, SW SE NW 29-3n-7e, dry at 3,076 ft., Glen Dean 2,471 ft., Cypress sand 2,734 ft., Benoist 2,837 ft., Ste. Genevieve 2,984 ft., McClosky 2,990 ft.

Edgar County: C. Fitzgerald 1 Biggs, NE NW SW 3-12n-13w, dry at 757 ft., St. Louis 680 ft.

Effingham County: National Associated Petroleum Corp. 1 F. & J. Uthell, SE SE NW 11-8n-6e, dry at 2,450 ft., Aux Vases 2,296 ft., Ste. Genevieve 2,377 ft., McClosky 2,403 ft.

Franklin County: Dee Miller Drlg. 1 S. Cockrum et al, SW SW NW 26-5s-1e, dry at 2,863 ft., Tar Springs 2,083 ft., Glen Dean 2,179 ft., Cypress sand 2,418 ft., Benoist 2,614 ft., Aux Vases 2,682 ft., Ste. Genevieve 2,755 ft., McClosky 2,848 ft.

Macon County: L. J. Castello 1 J. H. McKee, E½ NE NE 29-17n-3e, dry at 2,251 ft., Kinderhook 2,060 ft., Devonian 2,223 ft.

Montgomery County: M. H. Richardson 1 J. Sill, NW NW NW 23-7n-3w, dry at 2,326 ft., Ste. Genevieve 1,017 ft., Osage 1,550 ft., Louisiana 2,045 ft., Chattanooga 2,065 ft., Devonian 2,183 ft.

Wabash County: C. Zander 1 U. S. Tanquary, SE SE NW 31-2n-12w, dry at 2,449 ft.

G. Beuligman 1 Landes, SE NW SW 6-2s-12w, dry at 2,547 ft., Vienna 1,914 ft., Tar Springs 1,924 ft.

OHIO, KENTUCKY

Wayne County Well Has Large Flow From Clinton

COLUMBUS.—Ohio Fuel 2 A. S. Massie, Section 19, Congress Township, Wayne County, found the Newburg dry and drilled down to the Clinton sand. Upper Clinton at 2,936-44 ft. gaged 419,000 cu. ft.

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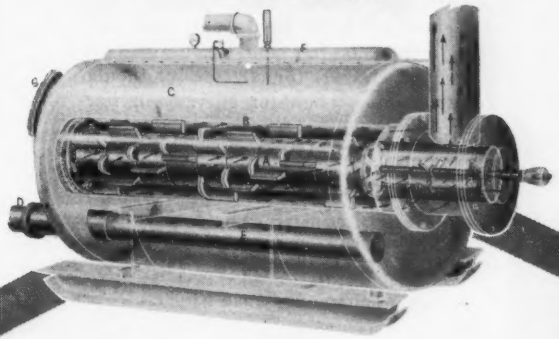

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and the lower sand, 2,966-78 ft., made 1,331,000 cu. ft., which was tubed natural.

Harmon et al 1 Harry Vandenburg, Lot 74, La Grange Township, Lorain County, extends the La Grange pool a location to the east. The upper Clinton, 2,438-45 ft., made 700,000 ft. natural and the lower sand topped at 2,453 ft. showed oil at 2,455 ft. The well was plugged back to produce the upper sand gas.

In the Cinnamon pool in Newton Township, Licking County, the Ohio Fuel completed on L. J. Rauch, 3 Qr., the largest open flow well yet drilled in. Shale at 1,017-1,275 ft. gaged 527,000 cu. ft. natural.

Cambridge field reported 10 locations, followed by Sandyville with 8, Lancaster 7, Stewart 6, Brush Creek 5, and Mt. Vernon and Ashland 1 each.

OHIO WILDCAT FAILURES

Morgan County, Malta Township: Industrial Gas 1 Frank Northrup, Sec. 9, Clinton 4,256-99 ft., Medina 4,352-62 ft., TD 4,362 ft.

EASTERN KENTUCKY

ASHLAND.—The Richard Stanley property in Pike County came in for a completion with better than 1,000,000 cu. ft. of gas to headline activities in the eastern Kentucky field of operations. Kentucky-West Virginia Gas Co. completed well No. 5,690 at a depth of 2,150 ft. for 1,107,000 cu. ft. of gas in the Big Lime.

Patterson, Dyer & Rader brought in 3 oil wells for a total of 23 bbl., completing the 1 William Vickers, Grassy Creek, Jackson County, at 1,017 ft. for 8 bbl.; the 1 Carl Wright, Blackwater Creek, Jackson County, at 1,116 ft. for 5 bbl., and the 1 Lee Bingham, Grassy Creek, Jackson County, at 1,027 ft. for 10 bbl.

WESTERN KENTUCKY

OWENSBORO.—Ryan Oil Co. has started a new wildcat venture in Daviess County about 7 miles east of the Birk City pool. It is the 1 L. R. Waitman, 6-P-29, located near the center of a 1,100-acre farm and approximately 1½ miles northwest of Owensboro. No indication was given as to how deep the well will be drilled.

Another new wildcat location announced during the week was the J. W. Carter et al 1 Green Heirs, NW NW SW 7-P-20, Union County. This venture is located about 2 miles northeast of the Uniontown pool.

Completions in the western Kentucky area during the past week totaled eight and included four oil wells and four dry holes. No wildcat completions were noted. New operations totaled eight and were located four in Daviess County, two in Henderson and one each in Union and Webster.

INDIANA

EVANSVILLE.—The Calvert & Willis 1 Henry Rickens, NE NW 1-5s-14w, Posey County wildcat, continued to drill ahead below 2,818 ft. at the close of the week after results of drill-stem tests proved disappointing. From an elevation of 394 ft., the well topped the Menard at 2,047 ft., Barlow at 2,583 ft. and the Glen Dean at 2,338-61 ft. with a slight show of oil. A 1-hour test of this show, however, recovered only 30 ft. of mud. Coring in the Benoist from 2,750-58 ft. resulted in the recovery of 8 ft. of poorly saturated sand.

Completions for the week totaled 15, of which 7 were oil wells and 8 were dry holes. No wildcat completions were reported. New operations announced during the week totaled 12 and included 5 in Posey County, 3 in Gibson, 2 in Vanderburgh and 1 each in Pike and Knox.

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MICHIGAN

Oceana County Discovery Flows 570 Bbl. Daily

SAGINAW.—Carter Oil Co. 1 Miller, discovery well in Section 11 of Claybanks Township, Oceana County, figuring in the week's 18 oil and gas completions reported in Michigan, was announced as having initial natural potential of 570 bbl. a day from Traverse limestone at 1,631 ft. Other production included a 50-bbl.-an-hour well in Arenac's Deep River field, a 130-bbl. daily producer in Bay County, a 10-bbl. well in Isabella. Other completions included 10 dry holes and 4 gas wells while 11 new locations were announced. Seven of the dry holes were wildcat failures.

MICHIGAN SUCCESSFUL WILDCAT

Oceana County, Claybanks Township: Carter Oil Co. 1 Martin H. Miller, NE SW SW 11-13n-18w, flowing 570 bbl., estimated, from Traverse lime, TD 1,631 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Cheshire Township: Ford Henry 1 M. E. Myers, C E½ SE SW 27-1n-14w, dry in Traverse, TD 1,293 ft.

Clyde Township: Harry Stroud 1 A. E. & J. Johnson, SW SW SE 29-2n-15w, dry in Traverse, TD 1,225 ft.

Ionia County, Ronald Township: McClure Drilling Co. 1 R. L. Pierson, SE SE NW 13-8n-6w, dry in Dundee, TD 3,019 ft.

Isabella County, Gilmore Township: J. V. Wicklund dba. Mogul Oil 1 M. E. Gamble, NW NW NE 23-16n-5w, dry in Dundee, TD 4,132 ft.

Lake County, Cherry Valley Township: C. W. Collin 1 John W. Pomorski, SW SE SE 14-18n-12w, dry in Monroe, TD 3,653 ft.

Ogemaw County, Logan Township: Sun Oil Co. 1 John Spannacher, SW SW SE 7-22n-4e, dry in Dundee, TD 2,932 ft.

Ottawa County, Jamestown Township: Crown Well Service 1 Hilbert Holleman, SE NE NW 23-5n-13w, dry in Traverse, TD 1,836 ft.

LA.-ARK.

Caddo Field Deep Test Bottomed at 7,340 Ft.

SHREVEPORT.—North Louisiana wildcat operations included N. A. Hendrickson et al 1 Muslow, 5-20n-15w, Caddo Parish (Caddo field deep test), a total depth of 7,340 ft. in shale. Perforations at 6,587-97 and 3,615-16 ft. were squeezed after testing salt water. In Bienville Parish, 13-17n-6w, Lion Chemical Corp. 1 Ozley was drilling below 8,275 ft. in shale. Electric log tops were: Tuscaloosa 3,736 ft., Glen Rose 4,510 ft., Massive anhydrite 5,325-5,602 ft., Rodessa 5,837-6,272 ft., and Travis Peak 7,125 ft. Ohio Oil Co.'s Haynesville field deep test, the 1 W. E. DeLoach, 22-23n-8w, had total depth of 10,740 ft. in lime. An unestimated amount of gas was killed and plug set at 10,108 ft. Perforations were to be made at 10,064-106 ft.

In Columbia County, Arkansas, McAlester Fuel Co. 1-A Warnock, 6-17s-19w, had total depth at 7,417 ft. in Smackover lime. Drill-stem test at 7,400-17 ft., open 12 minutes, recovered 2,000 ft. of water cushion cut with amber distillate. Top of Smackover porosity was 7,403 ft., by cores.

NORTH LOUISIANA WILDCAT FAILURE

Richland Parish: Sellers & Kellogg 1 Hemler, C NW NW SW 12-16n-6e, dry, TD 3,355 ft., Tuscaloosa 2,313 ft., Glen Rose 2,695 ft.

ARKANSAS SUCCESSFUL WILDCAT

Columbia County: Atlas Oil & Refining Co. 1 R. A. Wyane, C SW SW 8-16s-19w, discovery well, pumped 44 bbl. of oil per day from Pettit at 3,500-12 ft., Ozan sand with a show of oil 2,210-30 ft., Smackover 6,572 ft., TD 6,627 ft.

ARKANSAS WILDCAT FAILURE

St. Francis County: Coker, Martin & Beals 1 Bryan, NW SE SE SE 17-4n-3e, dry, TD 2,735 ft., no tops reported.

CANADIAN FIELDS

Important Test Starting In Old Foremost Field

CHATHAM.—In southern Alberta, an important new joint test is being started in the Foremost field where California Standard and Imperial Oil have location for Foremost-Province 13-17-5-11, in LSD 8, 17-5-11w4. Gas production was developed by the Canadian Western Natural Gas Co. more than 20 years ago. The new location is east of previous California Standard tests.

Lloydminster.—Three recent completions have indicated extension of the Lloydminster field in as many different directions. On the Saskatchewan side of the field, Withers-Lone Rock 1, NE LSD 13, 6-47-27w3, extending the field 12 miles southeast, is producing on the pump. Farther north and west, Northeast Syndicate D.B. 1, LSD 6, 13-48-28w3, finished at 1,866 ft. with sand at 1,856 ft., blew in with 11,000,000 cu. ft. gas, and when this was cemented off and plug pulled it came back with 25,000,000 cu. ft. and some oil. Attempts will be made later to reach an oil horizon below the gas.

On the Alberta side, 6 miles north of the nearest producer, Lloydbrook 1, LSD 1, 2-51-1w4, finished at 1,845 ft., set casing at 1,840 ft. and indicates a good producer.

Dina.—Testing for another potential extension of the Lloydminster field, Highwood-Sarcee Oils of Calgary has secured reservation on 10,800 acres in Townships 45-46-1w4, 25 miles south of Lloydminster and will start drilling in the spring. Acreage is north and east of the old Dina field.

MISSISSIPPI

Lincoln County Wildcat Testing at 10,409 Ft.

JACKSON.—Parker Drilling Co.'s wildcat, the 1 Arrington, 29-8n-7e, in Lincoln County, had total depth at 10,464 ft. on last report and was testing. With the packer set at 10,409 ft., a 15-minute drill-stem test recovered 20 stands of water cushion and 39 stands of clean oil, through ¼-in. chokes top and bottom. Bottom-hole flowing pressure was 2,950 lb., open, which climbed to 3,175 lb. when shut in. Operators planned to core ahead to 10,500 ft. to determine the extent of the pay zone.

Crescent Drilling Co. 1 Vernon, 31-8n-7e, swabbed 51 bbl. of oil and 30 bbl. of salt water in 17½ hours while waiting on pumping unit.

In Hinds County, Kingwood Oil Co. 1 Plummer, 14-5n-1w, was fishing drill pipe stuck in the top of the gas rock at 3,200 ft.

MISSISSIPPI WILDCAT FAILURE

Rankin County: Phillips Petroleum Co. 2 Denkman Lbr. Co. W/2 NW NE 23-7n-4e, dry, TD 5,550 ft., no tops reported.

MISSISSIPPI SUCCESSFUL WILDCAT

Adams County: Phillips Petroleum Co. 1 Mrs. Vic Artman, 36-8n-2w, flowed 113

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bbl. of 40.9°-gravity oil per day from Wilcox at 5,618-22 ft. through 10/64-in. tubing choke, Pine Ridge discovery well, no tops reported, TD 5,684 ft.

APPALACHIAN FIELD

Large Gasser Completed in Roane County, West Virginia

PITTSBURGH.—In Reedy district, Roane County, West Virginia, Glen W. Roberts, Agent, completed a large Berea gas well in a test on Walter Hoffman farm which had a final open flow of 4,448,000 cu. ft. from the Berea at 2,351-59 ft. Rock pressure was 920 lb. in 24 hours and total depth was 2,359 ft.

In Elk district, Kanawha County, where three Oriskany failures were reported this week, Joe Rubin topped the Oriskany sand at 5,020 ft. in the test Alfred Phillips, and 21 ft. in that formation has a showing of 389,000 cu. ft. gas. In Malden district, Spartan Gas Co. topped the Oriskany at 5,374 ft. in No. 3 Blue Creek Coal & Land Co. and at 5,404 ft. no gas has been reported.

New locations totaled 27 for the week and were located in Kanawha, Lewis, Lincoln, Marion, Mingo, Nicholas, Ritchie, Upshur, Wayne, Wirt, Wood, and Wyoming counties.

In Bell Township, Clearfield County, southwest Pennsylvania, the important wildcat of F. C. Deemer on Alice Irwin farm is proving somewhat an enigma as at 7,605 ft. or 181 ft. below the top of the Onondaga lime, no Oriskany sand has been logged, whereas no pinch out of that sand body is expected. The present formation is black lime.

New locations totaled only two and were located in Armstrong and Jefferson counties.

CALIFORNIA

South Belridge Deep Test Reported Flowing Oil

LOS ANGELES.—Belridge Oil Co. 62w-33, a deep test in the South Belridge field of Kern County, is back in the limelight following reports that the well flowed an undetermined volume of oil last week end on a test of Point of Rocks equivalent. After drilling to 13,975 ft., the operator has been testing by stages from bottom back to 10,000 ft. A string of 5 9/16-in. casing was set recently at 13,945 ft. The well has been carefully drilled and there have been recurring reports of a deep sand discovery.

Efforts to free stuck drill pipe in Pacific Western Oil Corp. 1 National Royalties, world's deepest well in 5-26s-22e, Kern County, have met with no success. Cutters were run in the hole this week and 11,550 ft. of the pipe was recovered with one cut. Contractor will wash over and make additional cuts in the hope of cleaning out the hole to bottom and resuming drilling. This is considered a long shot, however. Electric log will be run in the event of failure to recover fish and any uphole showings will be tested prior to abandonment.

Apex Petroleum Corp. has brought in 1 Cattani in the Arvin area of the Mountain View field from the lower Chanac flowing 1,200 bbl. of 31°-gravity clean oil through a 22/64-in. choke from perforated interval at 6,560-6,620 ft. Significance of the completion is that production in the Arvin area of the field is from Etchegoin sands although the Chanac is productive elsewhere in the field. The well is a former Etchegoin producer taken over by Apex from Superior Oil Co. and deepened from 6,152 to 6,930 ft. As a result of this completion several deepening jobs are in prospect.

Superior Oil Co. is preparing to do some exploratory work in the Goshen area of Tulare County shortly after the first of the year, the company will spud 1 Huntley in 7-18s-24e. Incentive for the test is the wildcat recently drilled ½ mile west by United Exploration Co. which cored oil sand streaks from 3,590 to 3,615 ft.

A revival of drilling is scheduled to occur next year in the 40-year-old Arroyo Grande field of San Luis Obispo County. The Adams Oil Co., principal operator in this almost dormant heavy oil field, is reported planning to drill 15 wells. The company also contemplates an asphalt and road oil plant in which to process its production.

Richfield Oil Corp. has abandoned 33-1 Boyle Community, Los Angeles County, a wildcat with completely enclosed derrick in a densely populated neighborhood in East Los Angeles. Well was drilled to 5,902 ft., then redrilled to 5,650 ft. without encountering showings.

Latest prospector to be attracted to the area north and east of the Oak Canyon field in Los Angeles County is Shell Oil Co. which has staked location for 515-29 Shell-U.S.L. in 29-5n-17w, 1½ miles west of a wildcat recently spudded by Universal Consolidated Oil Co. Shell's location is about 1 mile north of the field.

CALIFORNIA WILDCAT FAILURES

Stanislaus County: Superior Oil Co. 1 Sinclair Community, 5-5s-9e, TD 4,145 ft.

Yolo County: General Petroleum Corp. 1 Gallenkamp, 10-6n-3e, TD 4,912 ft.

Los Angeles County: Richfield Oil Corp. 33-1 Boyle Community, 31-1s-12w, TD 5,902 ft., redrilled to 5,650 ft.

CALENDAR

January

Board of directors, Rocky Mountain Oil and Gas Association, Townsend Hotel, Casper, Wyo., January 6.

Society of Automotive Engineers, annual meeting and engineering display, Book-Cadillac Hotel, Detroit, January 6-10.

Southern California Meter Association, Rio Hondo Country Club, Downey, January 16.

Western Petroleum Refiners Association, technical group meeting, Washington-Youree Hotel, Shreveport, January 17.

February

Southern California Meter Association, Rio Hondo Country Club, Downey, February 20.

March

American Society of Mechanical Engineers, spring meeting, Mayo Hotel, Tulsa, March 2-5.

American Institute of Mining and Metallurgical Engineers, annual meeting, and World Conference on Mineral Resources, Waldorf Astoria Hotel, week of March 17

Southern California Meter Association, Rio Hondo Country Club, Downey, March 20.

Western Metal Congress and Exposition, Oakland, Calif., March 22-27, 1947.

Western Petroleum Refiners Association, annual membership meeting, San Antonio, March 24-26.

Oil Heat Institute of America, annual convention, Traymore Hotel, Atlantic City, N. J., March 24-30.

April

National Association of Corrosion Engineers, annual convention, Palmer House Chicago, April 7-10, 1947.

Indiana Independent Petroleum Association, spring convention, Springs Hotel, French Lick, April 9-10.

Board of directors, Rocky Mountain Oil and Gas Association, Northern Hotel, Billings, Mont., April 10-11.

Southern Gas Association, Biloxi, Miss., April 16-18.

Division of Production, American Petroleum Institute, Eastern District spring meeting, Pittsburgh, April 16-18.

Southern California Meter Association, regular monthly meeting, Rio Hondo Country Club, Downey, April 17.

Natural Gasoline Association of America, annual meeting, Baker Hotel, Dallas, April 23-25.

Natural Gas Department, American Gas Association, spring meeting, Stevens Hotel, Chicago, April 30-May 2.

May

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, May 6-8.

Southern California Meter Association, Rio Hondo Country Club, Downey, May 15-22.

Division of Production, American Petroleum Institute, Mid-Continent District spring meeting, Amarillo, Tex., May 22-23.

Division of Production, American Petroleum Institute, Pacific Coast District spring meeting, Los Angeles, May 15-16.

Indiana Gas Association, Springs Hotel, French Lick, May 15-16.

Pennsylvania Gas Association, Wernersville, Pa., May 20-22.

June

Canadian Gas Association, General Brock Hotel, Niagara Falls, N. Y., June 16-18.

Southern California Meter Association, Rio Hondo Country Club, Downey, June 19.

Board of directors, Rocky Mountain Oil and Gas Association, Canyon Hotel, Yellowstone Park, June 26-28.

September

National Butane-Propane Association, annual convention, Jefferson Hotel, St. Louis, September 15-17.

Pacific Coast Gas Association, Coronado Hotel, San Diego, September 23-25.

American Gas Association, annual convention, San Francisco, September 29-October 3.

Los Angeles Geology Forum Draws Record Attendance

LOS ANGELES.—The largest group in the 2-year history of the Los Angeles Geological Forum, launched as an informal discussion group under sponsorship of the Pacific Coast Section, American Association of Petroleum Geologists, heard three speakers at the December meeting last week. More than 200 attended and constituted an overflow crowd at the General Motors Corp. auditorium.

H. H. Sullwold, Jr., consultant, Los Angeles, discussed the West Newport oil field and presented data of his own compilation as well as information supplied by his coauthor, A. L. Hunter, another consultant who lives at Hermosa Beach.

Technique of locating oil sands in fresh-water areas by electric logging was discussed by Shannon Baker, manager of the San Joaquin Valley division, Lane-Wells Co.

R. B. Moran discussed recent developments in Peru, pointing out the interest currently manifested by at least four major companies which are investigating the potentialities in the eastern part of the country.

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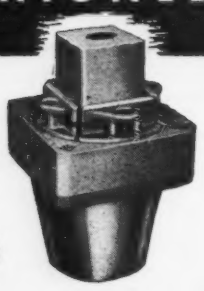

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Drilling Contractors

Clyde D. Hall, Los Angeles, is the contractor on Union Oil Co. 95, 96, and 97 Stearns, three new authorized locations in the Brea field, Los Angeles County, California.

Holmes Drilling Co., Bakersfield, has spudded Calumet Gold Mines Co. 1 Delaney-Cinnabar, a wildcat project in 24-2s-11w, Whittier area, Los Angeles County, California.

Regent Drilling Co., of Calgary, Alta., is moving equipment to resume drilling at Shunda-Lion-Taber 1, LSD 4, 25-7-15w4, in the Taber field, southern Alberta. Contract has been taken to complete the well from 460 ft.

Harry L. Edwards has contract for Sohio Petroleum Co. 4-B Claudius Fontenot, a west flank test at Bon Air, Jeff Davis Parish, South Louisiana. Contract depth is 9,800 ft.

Nicklos Drilling Co. will drill Continental Oil Co.'s 10,000-ft. extension test at the 1 Roosevelt Gobert. Location is 1 mile north of production in the Reddell field, western Evangeline Parish, Louisiana.

R. H. Gracey Drilling Co. has contract for Union Oil Co. of California's 12,000-ft. wildcat on the Chenier Au Tigre prospect in Vermilion Parish, South Louisiana. Location is 1 mile east of nearest gas and distillate production in the Fresh Water Bayou field. The test is the 1 Jan Jean Lafitte, in Section 35-16s-2e.

Sam Tennant Drilling Co., Blackwell, Okla., is drilling at 2,000 ft. in SE NE SW 30-27n-2e, Kay County, Oklahoma, for Russell Maguire, Wichita. Contract is for Layton sand test.

Dixie Drilling Co. has contract for Gulf Refining Co. 20 Wilson & Cochran at Port Barre, St. Landry Parish, Louisiana. Location is in Section 4-6s-5e. It is scheduled to test the Frio zone.

Loffland Brothers will drill Gulf Refining Co. 14 State "PP," Section 2-23s-30e, in the West Bay area, St. Mary Parish, Louisiana. It is scheduled to test the Miocene at around 11,000 ft.

Herndon Drilling Co. has made location for the 1 Bennett, N½ NW SE 25-20n-4w, a wildcat test northeast of Marshall in Garfield County, Oklahoma. The lease is a farmout from Carter Oil Co. and support is being furnished by other nearby operators. Nearest production is in the Browns pool, 4 miles northwest.

Fleet Drilling Co. and Norbla Oil Co. have staked location for a wildcat to test the Cromwell sand in Seminole County, Oklahoma. The venture will be known as the 1 Reed Estate and location is in NW NE

Crew of Corbett Drilling Co. on location in the West Moore pool, Texas. The men are Jeff Mathis, backup man; Floyd Williams, production foreman, Kenwood Oil Co.; Dale Fullbright, pipe racker; C. J. Markin, derrick man; C. H. Gaston, tool pusher, and Wesley A. Reed, driller

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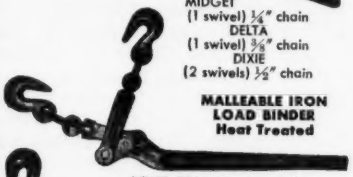

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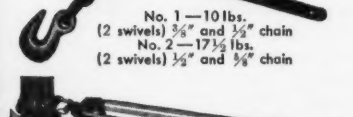

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NE 2-5n-7e, east of a regional fault traversing the sector. The Sasakwa field, about 1½ miles to the north, has produced some prolific wells from the Wilcox sand, but it is understood that the new test will not be carried to the Wilcox unless it runs considerably high on upper markers.

Bennett & Roberts Drilling Co. has plugged back from a total depth of 3,300 ft. and is running casing to 3,166 ft. to test shows of oil in the Lansing lime in their Ellsworth County, Kansas, wildcat, the 1 Dobrinski, NW NW NE 16-17-9. Good shows were logged in the Lansing at 2,986-3,026 ft. and at 3,104-14 ft. Nearest production is in the Stoltenberg pool, 2 miles to the east.

Nelson Drilling Co. and Charles Seaney have staked location for the 1 Peters, SE SE NE 4-20-1e, 1¾ miles south of the Lehigh pool in Marion County, Kansas. The lease is a farmout from Bay Petroleum Co.

Lupher Drilling Co. is credited with establishing a Michigan record by setting 459 ft. of 20-in. casing to start the Ohio Oil Co. 3 Steadman, NW NW 29-18n-10w, a deep test in the Reed City field of Osceola County. Drilling is now progressing below 1,300 ft., and present plans call for setting 8-in. casing through the Dundee-Monroe formation at around 3,600 ft. to provide a large hole to the top of the Richfield.

Merrill Drilling Co., et al, have been granted permit to drill the 1 C. C. Matteson, SW SW SE 12-15n-5w, Isabella County, Michigan. This venture is a follow-up test to a recently drilled wildcat about ½ mile to the northeast which showed considerable free oil.

Jones, Shelburne & Farmer, Inc., Oklahoma City, are below 4,200 ft. at their Hewitt 1, a rank wildcat in 15-13s-30w, Gove County, Kansas. The well is to test the Mississippi lime, expected at approximately 4,400 ft. and the Arbuckle at 4,800 ft.

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PERSONALS

Burrell Promoted to Division Head for Ohio Oil Co.

IVAN G. BURRELL, superintendent of production in the Bridgeport (Ill.) district for Ohio Oil Co., will become division superintendent of the company's Marshall division effective January 1. Announcement of his promotion was made last week by W. B. Emery, vice president and manager of production.

Burrell will take over the post formerly held by A. J. Rosenlieb, who was recently made division manager at Marshall, Ill. The Marshall division embraces Ohio Oil's producing operations in Illinois and Indiana.

Like so many of the men holding executive and supervisory jobs in the oil industry, Burrell combines a formal engineering education with practical oil-field experience that started at the bottom of the ladder. Following his graduation from the Colorado School of Mines in 1931, Burrell took a job with Ohio Oil in the Casper (Wyo.) division working with a core drilling outfit in the Nebraska area. He was then transferred to the general offices at Findlay and worked for a short time in the title and tax department. On his request for more field experience, he was transferred to East Texas where for 3 years he worked as a roustabout.

In July 1936, he was promoted to assistant district engineer, Rhodessa field, Texas, and a year later to foreman. Then following a year in the Kentucky fields, he was transferred and promoted to division petroleum engineer for the Marshall division. In January 1945 he was advanced to superintendent of the Bridgeport district.

Glen A. Campbell, of Glenn Drilling Co., Tulsa, and formerly associated with the Petroleum Administration for War, has been appointed manager of drilling operations for Spartan Drilling Co. and soon will open offices in Shreveport, La.

Roy H. Laird, East Texas operator and mayor of Kilgore, Tex., and **Verne Fagin,** Texas independent operator, were recent visitors in Los Angeles and at other West Coast points.

A. W. Sullivan, geologist for Carter Oil Co., has been transferred from Cut Bank, Mont., to the San Juan basin, Colorado.

Frank B. Rees was due to return to the United States this month after 2½ years in Russia as instrumentation - correlation engineer in the design - engineering department of E. B. Badger & Sons Co., New York. Rees, whose home is in Ponca City, Okla., is former head of the instrumentation department of Continental Oil Co. Before going to Russia, he was engaged in war-plant construction in the eastern and southern parts of the United States.

E. F. Battson, assistant to Dan Moran, president of Continental Oil Co., has been elected president of Continental Steamship Co., Baltimore, a subsidiary of Continental. Battson, who has been with Continental 25 years, will handle the steamship-company assignment in addition to his other duties.

Wayne Brawley, manager of Northern Ordnance, Inc., has been elected president of the newly organized Middle District Producers Association, formed to promote production through secondary - recovery operations in central Pennsylvania. **Chauncey Gray,** general manager of Patoil Corp., was named vice president, and **Frank Lyons,** of the Pennsylvania Gas and Oil Management Associaiton, secretary-treasurer.

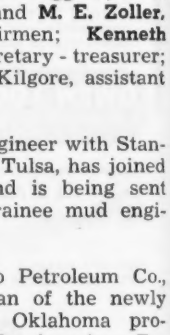
C. P. Zebal has been transferred from New Orleans to Denver as Rocky Mountain development geologist for The California Co.

William J. Wagner, junior engineer, has been transferred by Shell Oil Co., Inc., from Los Angeles office to the Ventura coastal division. **George S. Dealy,** operator, has been transferred to the Ventura coastal division from the San Joaquin division.

F. J. Mikeska, Kilgore, last week was elected chairman of the East Texas chapter of the American Petroleum Institute. He succeeds **N. N. Jones,** Gladewater. Other new officers are: **T. G. Frick,** Greggton; **J. N. Miles,** Gladewater, and **M. E. Zoller,** Kilgore, vice chairmen; **Kenneth Mills,** Kilgore, secretary - treasurer; and **Phill Lehnard,** Kilgore, assistant secretary-treasurer.

Harold Hansen, engineer with Stanolind Oil & Gas Co., Tulsa, has joined Tropical Oil Co. and is being sent to Colombia as a trainee mud engineer.

J. H. Field, Sohio Petroleum Co., was elected chairman of the newly reactivated Central Oklahoma production chapter of the American Petroleum Institute. Other new officers are: **D. L. Dooley,** Stanolind Oil & Gas Co., first vice chairman; **F. M. Carroll,** Shell Oil Co., Inc., second vice chairman; **Glenn M. Stearns,** West Edmond Pool Engineering Association, secretary; and **Stanley Betzer,** Phillips Petroleum Co., treasurer.



Dr. William Noble Lacey, dean of graduate studies of California Institute of Technology and a consultant for several corporations, will receive the Anthony F. Lucas Gold Medal for 1947 from the American Institute of Mining and Metallurgical Engineers. Vote of the institute's board of directors was unanimous in the selection of Lacey to receive the award, given in recognition of "distinguished achievement in improving the technique and practice of finding and producing petroleum."

Max W. Ball, newly appointed director of the Oil and Gas Division of the Department of Interior, visited Tulsa and other points this week. With Mrs. Ball he spent Christmas day with their son, Douglas S. Ball, gas engineer with Phillips Petroleum Co., Dumas, Tex.

Frank H. Harrell has been elected vice president of Midstates Oil Corp. by the firm's board of directors. Harrell has been in charge of the Shreveport, La., district, covering Louisiana, Mississippi, Eastern Texas, and Arkansas, since its organization 10 years ago. Previously he was in charge of the East Texas area. He has been with Midstates Oil more than 25 years.

Harry H. Mack, 44, vice president of Sunray Oil Corp., is being transferred from Tulsa to Los Angeles, where he will be in charge of the company's producing and exploration activities.

O. M. Evans, Los Angeles, has been named vice president of Pacific Western Oil Corp., which recently set a world's drilling-depth record with its Kern County test in California. Evans, who was associated with Skelly Oil Co. in the Mid-Continent area for about 22 years, became general field superintendent for Pacific Western in 1942. In his new position he will be in charge of production and drilling operations in California and the Rocky Mountain area. Pacific Western recently set a world's deep-drilling record with its Kern County, California, test.

Wallace Chickering, formerly with Oklahoma Natural Gas Co., has joined Creole Petroleum Corp. as a geologist and is being sent to Eastern Venezuela.

F. H. Lerch, Jr., president, Consolidated Natural Gas Co., New York, has been elected chairman of the finance and control committee of the American Gas Association by the association's executive board.

R. REA JACKSON

R. Rea Jackson, general superintendent of the Beaumont, Tex., refinery of Magnolia Petroleum Co. for the last 10 years, has been appointed manager of Socony-Vacuum's Paulsboro, N. J., refinery. He succeeds **Howard W. Sheldon,** who has been transferred to New York as assistant director of Socony-Vacuum laboratories. In another Socony-Vacuum move, **George D. McDaniel** was named manager of the eastern marketing region to succeed **John M. Martin.** McDaniel formerly was manager of the southeastern division with headquarters in Baltimore.

DR. W. J. SPARKS

Dr. William J. Sparks, associate director of the chemical division of the Esso Laboratories, Standard Oil Development Co., has been named director of the division. He succeeds **Dr. Per K. Frolich,** who has resigned after 11 years' service in the position. Sparks is widely known for his work in the development of synthetic rubber from petroleum.

Joe C. Kahl, Northwest division chief scout for Carter Oil Co., has been transferred from Billings, Mont., to Tulsa. **Harry C. Chapman,** Carter attorney at Billings, was named assistant manager of the Northwest division. Other transfers announced by Carter include **John O. Campbell, Jr.,** Tulsa, former chief scout, to assistant to the manager of the Northwest division, and **A. L. Deaton,** from the legal department in Tulsa to the legal staff in Billings.

VIC E. BAUM

Vic E. Baum, who resigned recently as president of Bace Oil Co., Wichita, Kans., has been appointed assistant to the president of Kansas-Nebraska Natural Gas Co. **S. D. Whiteman,** company president, said Baum will be located in Scott City, Kans., and will coordinate all drilling, producing and operating activities in Southwest and South Central Kansas.

Frank Hamilton Henry, executive in charge of the Middle-East division of Socony-Vacuum Oil Co. and member of the foreign trade committee, is the chairman of the recently organized initial-gifts committee of the Fund for Near East Colleges, created for the rehabilitation and expansion of eight American colleges in six Near East countries of Europe and Asia.

Charles W. Teater, Saginaw independent producer, has been elected president of the Oil and Gas Association of Michigan, succeeding **W. P. Clarke,** land and geological-department manager of Gulf Refining Co. Other officers, all reelected, are: **George Talbot,** vice president; **William Peck** and **O. H. Kristofferson,** treasurers; **Harold M. McClure,** executive secretary; and **Arthur H. Ledbetter,** business secretary.

SHIFTS—

N. J. Lea, foreman, The Texas Co., Santa Barbara, Calif., to Bakersfield, Calif.; **Charles F. Manlove,** geologist, Union Oil Co. of California, Santa Maria, Calif., to Lompoc, Calif.; **Russell B. Travis,** geologist, Standard Oil Co. of California, Bakersfield, Calif., to Forestville, Calif.; **Joseph G. Wink,** engineer, Bechtel Brothers - McCone, Los Angeles to San Francisco; **John R. Phillips,** engineer, Shell Chemical Corp., Concord, Calif., to Louisville.

C. J. Gosselin, engineer, Howes & Whitaker, Redlands, Calif., to San Bernardino, Calif.; **H. D. Cary,** superintendent, Anzac Oil Corp., Coleman, Tex., to Bangs, Tex.; **Bowen** Davidson, geologist, Magnolia Petroleum Co., Huntsville, Tex., to Andalusia, Ala.; **Eugene F. Lewis,** engineer, Phillips Petroleum Co., New London, Tex., to Oklahoma City; **E. L. Wells,** foreman, Continental Oil Co., Pittsburg, Tex., to Mineola, Tex.

Evan Watts, foreman, Magnolia Petroleum Co., Andalusia, Ala., to Cuba, N. M.; **Eugene Graham,** producer, Mid-West Drilling Co., Salem, Ill., to Mt. Vernon, Ind.; **Paul Duncan,** superintendent, A. E. Williams, Ashley, Mich., to Bannister, Mich.; **W. C. Emmons,** superintendent, Standard-Vacuum Oil Co., Portland, Me., to Wewoka, Okla.; **Thomas H. Cole,** engineer, Inland Drilling Co., Rangely, Colo., to New York.

Maloy Stevenson, engineer, Refinery Engineering Co., Arkansas City, Kans., to Tulsa; **T. B. Whitson,** superintendent, Helmerich & Payne, Inc., Copeland, Kans., to Great Bend, Kans.; **Myron C. Metcalf,** geologist, Phillips Petroleum Co., Wichita, Kans., to Anadarko, Okla.; **R. L. Wales,** foreman, The Texas Co., Malta, Mont., to Farmington, N. M.; **Don E. Evert,** engineer, Union Oil Co. of California, Cut Bank, Mont., to Madison, Kans.

Joe J. McCullough, geologist, Union Oil Co. of California, Cut Bank, Mont., to Madison, Kans.; **Charles Lewis Rose,** engineer, Natural Gas Pipeline Co. of America, Beatrice, Neb., to Great Bend, Kans.; **Rex M. Grivetti,** geologist, The Texas Co., Olympia Wash., to Vernonia, Ore.; **R. M. Holder,** foreman, Ohio Oil Co., Elk Basin, Wyo., to Grass Creek, Wyo.; **R. N. Harding,** foreman, The Texas Co., Cody, Wyo., to Greenville, Miss.

Robert Baum, foreman, Seismograph Corp., Holdenville, Okla., to Shawnee, Okla.; **L. Bunch,** superintendent, Oklahoma Natural Gas Co., Sapulpa, Okla., to Owasso, Okla.; **R. V. Gerner,** superintendent, Phillips Petroleum Co., Edmond, Okla., to Oklahoma City; **K. P. Huffman,** engineer, Sohio Petroleum Co., Edmond, Okla., to Columbus, Ohio; **John H. Nelimark,** geologist, Tulsa, to Longview, Tex.; **Norbert A. Parker,** geologist, E. I. duPont de Nemours & Co., Tulsa to Jacksonville, Fla.

Equipment Men in the News

Detroit Diesel Selects Campbell and Brown

Appointment of John C. Campbell as manager of industrial engine sales, and of James W. Brown as advertising manager,

J. C. CAMPBELL

JAMES W. BROWN

was announced recently by V. C. Genn, general sales manager for Detroit Diesel Engine Division of General Motors Corp. The appointments were made by Genn at a sales conference held recently in Detroit where plans were laid for activities during 1947.

New Advancements in Second National

L. R. Bryan, Jr., president of Second National Bank, Houston, announced the promotion of seven employes, authorized by the board of directors in its regular monthly meeting, December 10. Promoted to the position of vice president were R. R. Claghorn, manager of foreign department; L. B. Herring, manager of oil and gas division, and Oran "Dooley" Dawson, manager of agricultural department. Promoted to the position of assistant vice president from assistant cashier were J. P. Smith, head of the credit department, and J. S. Newman, head of the personal-loan department. Made assistant cashiers were H. Rex Wheeler, personal-loan officer, and Ed Gardiner, head of the transit department.

Gar Wood Adds Whitworth And Murphy

W. H. Hammond, vice president in charge of sales of Gar Wood Industries, Inc., announces two additions to his staff, Robert F. Whitworth as division sales coordinator, and George W. Murphy as branch sales coordinator.

Feemster Sales Representative for American Iron & Machine

R. A. Feemster has been employed by American Iron & Machine Works Co. as special sales representative out of the Oklahoma City office. Feemster, prior to his present position, served as division sales manager for Kobe Co. for approximately 5 years.

Carter Appointed District Manager

Charles C. Carter, formerly field salesman of the Oklahoma City store of Jarecki Manufacturing Co., has been appointed district manager with headquarters at Bartlesville, Okla.

Cameron Iron in New Quarters

Cameron Iron Works, Inc., has moved into its new administrative offices and manufacturing plant located at Katy and Silber roads, Houston, according to an announcement by E. L. Lorehn, vice president and general manager. Prior to moving to the new location, plant and headquarters were at 711 Milby Street. The company asks that all correspondence be addressed to Post Office Box 1212, Houston.

Field Personnel Changes In Goodyear Tire

Appointment of Philip X. Navin as field engineer for the New York district of Goodyear Tire & Rubber Co., is announced by W. C. Winnings, mechanical goods division manager. Other staff changes include Charles O. Roome, who is now manager of the St. Louis district. John E. Ragan, manager of the St. Louis district since 1935, has been transferred to Atlanta as district manager of mechanical goods sales. Philip C. Antoine is new field representative at New Orleans, and Richard P. Goodenough succeeds Antoine at Memphis. Charles H. Murtaugh and Carl Baker are field representatives of South Bend, Ind., and Charlotte, N. C., respectively.

Beard Joins Republic Supply

Announcement has been made by Republic Supply Co., Houston, of appointment of Eugene H. Beard to their sales staff with headquarters in Tulsa, where he has been active in supply circles for 7 years.

Drott Manufacturing Completes New Quarters

Completion of new office and manufacturing buildings at 4344 North Green Bay Avenue, is announced by E. A. Drott, president, Drott Manufacturing Corp., Milwaukee.

Freeman Joins Ajax Iron Works

Ajax Iron Works, Corry, Pa., announces appointment of Walter F. Freeman as a company sales representative. He has been assigned the territories of Kansas, Oklahoma, the Rocky Mountain area, Michigan and Illinois.

Pittsburgh Steel Changes Sales Organization

CARL L. ZAK

Pittsburgh Steel Co. has announced changes in its general sales organization effective now and January 1, 1947. Carl L. Zak, formerly assistant sales manager, has been appointed general manager of sales effective immediately. Other changes effective January 1 include the appointment of L. A. Ver Bryck as assistant general manager of sales. Succeeding Ver Bryck as New York district manager of sales is Joseph G. Smith, who has been manager of Pittsburgh district sales until this new appointment. Walter D. Schlundt, former district sales manager at Detroit, will replace Smith as district sales manager at Pittsburgh. Named as assistant district sales manager in the home office is Robert W. Mullin. Edward L. Dull becomes district sales manager at Detroit. He had previously been connected with Pittsburgh Steel Co.'s Chicago office.

Vapor Recovery Opens Ohio Office

Vapor Recovery Systems Co., Los Angeles, announces the opening of a direct factory sales and engineering office at 1501 Euclid Avenue, Cleveland. T. L. Reibling has been appointed district manager. The company now has service offices in New York, Cleveland, Chicago, Tulsa, eastern Texas, and Compton, Calif., in addition to over 200 sales agents.

Codrington and Knaves Elevated in Allis-Chalmers

Charles F. Codrington has been promoted from assistant to manager to sales manager of the blower and compressor department of Allis-Chalmers Manufacturing Co., Milwaukee, succeeding A. E. Caudle, resigned. Albert R. Knauss, formerly of the Tulsa district office, has been named manager of the firm's office at Memphis.

Hydril Opens Tulsa Office

Hydril Corp., Los Angeles, has recently opened an office at 318 Thompson Building, Tulsa, with William Miller, Jr., in charge. Miller will offer engineering sales and service to the oil industry for the company's blowout preventers. Branch plants are at Houston and Youngstown.

At the annual sales and engineering conference of member companies of Dresser Industries, Inc., held recently at Edgewater Beach Hotel, Chicago, were: (center) J. B. O'Connor, executive vice president of Dresser Industries; (left) John Avery, president and general manager of Roots-Connersville Blower Corp., Connersville, Ind.; and (right) Eric Flascher, general manager of Stacey-Dresser Engineering Division, Cleveland

UNITED STATES

Produces daily about 4,800,000 bbl. of crude plus 300,000 bbl. of natural gasoline and allied products. Imports daily 250,000 bbl. crude plus 130,000-150,000 bbl. refined products (mostly fuel oil). Exports daily about 100,000 bbl. crude and 330,000 bbl. refined products (mostly gasoline, kerosene, and light distillates). Refines about 4,800,000-4,900,000 bbl. crude plus 300,000 bbl. natural gasoline.

Of current production, state of Texas accounts for about 44 per cent; California 18 per cent; Louisiana, and Oklahoma 8 per cent each; 22 per cent scattered among 20 other states.

Of 5,300,000 bbl. refining capacity, 34 per cent is in Texas and Louisiana, mostly along Gulf Coast; 18 per cent is in California; 13 per cent is in Pennsylvania and New Jersey, mostly along Atlantic Seaboard; 10 per cent is in Illinois and Indiana, much of it in the Chicago area; 8 per cent is in Oklahoma and Kansas; remaining 17 per cent is scattered in 27 states.

MEXICO

Present production 129,000 bbl. daily, refining capacity rated 152,000 bbl. Production divided 114,000 bbl. daily in Tampico area, with Poza Rica field accounting for 69,000 bbl. of this; remaining 15,000 bbl. daily in Isthmus of Tehuantepec. Small condensate production with gas from fields near Texas border. Government-operated industry, since 1938 expropriation, suffering from three things: Political mismanagement; growth of domestic consumption requiring reversal of facilities built for export markets in order to serve internal market; failure to expend enough capital each year on exploration for new fields and for new and modern refining, transportation, and distribution equipment. Poza Rica's 60,000-bbl. production comes from 65 flowing wells in Tamabra lime (Cretaceous), averaging 300 ft. of pay at 7,250-7,550 ft. About 800 flowing wells, 200 pumpers, 20 gas wells in all other fields.

WASH 1-6.0 · OREGON · CALIF · NEVADA · IDAHO · UTAH · ARIZONA · NEW MEX · COLORADO · WYOMING · MONTANA 10-42.6 · N DAKOTA · S DAKOTA · NEBRASKA · KANSAS · OKLA · TEXAS · MINNESOTA · IOWA · MISSOURI · ARKANSAS · LOUISIANA · WIS · ILLINOIS · IND · MICH · TENNESSEE · MISS · ALA · FLORIDA

1-2.1 · 1-0.1 · 27-80.1 · 4-23.1 · 7-14.5 · 55-964.1 · 8-15.4 · 6-76 · 1-26.5 · 19-190.5 · 27-216.2 · 7-48.4 · 14-304.5 · 89-1,492.0 · 2-4.5 · 1-5.0 · 18-90 · 19-7[illegible] · 4-25[illegible] · 7-51.5 · 2-6.0 · 2-7.0

TEXAS

• Torreon · Monterrey · MISA · LA PRESA · NORTHEAST GAS REG · RANCHERIAS · MISION

• Mazatlan · • Guadalajara

PANUCO · CORCOVADO · EBANO-PANUCO · CACALILAO · TOPILA · CHIJOL · EBANO · EL LIMON · CERRO AZUL · POTRERO · TIERRA BLANCA · ALAMO · POZA RICA · FUBRERO · SALINAS · Tampico · DOS BOCAS · TEPETATE · NARANJOS · ZACAMIXTLE · GOLDEN L[illegible] · Tuxpan · POZA

ATZCAPOTZALCO · MEXICO CITY · Acapulco · Oaxaca · MINA

ARUBA · CURACAO · Las Piedras · GULF OF · CARIB

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MAINE
NEW YORK
VERMONT
NEW HAMP.
MASS
2-54.0
CONN
R.I.
3-10.4
7-80.7
PENNA.
18-90.9
24-426.3
297.0
10-209.2
W VIRG
4-64.9
1-3.5
OHIO
3-11.5
1-2.0
VIRGINIA
N CAROLINA
KENTUCKY
S. CAROLINA
GEORGIA
1-7.2
1-4.0
FLORIDA

ARCTIC OCEAN

Nome
ALASKA
Fairbanks
Anchorage

F.T. NORMAN
WHITEHORSE

CANADA

Produces 21,000 bbl. daily, refines 210,000 bbl. per day, importing most of it. Of producing areas, Turner Valley field near Calgary accounts for about 17,000 bbl. daily; old fields in New Brunswick and Ontario in east and central parts for 200 and 300 bbl. respectively; Canol project at Fort Norman near Arctic Circle now producing about 500 bbl. for local needs; balance from other fields of Alberta and Saskatchewan Provinces. Refineries operating mostly on imported crude; Nova Scotia capacity 34,000 bbl.; Montreal area capacity 68,000 bbl.; Toronto area capacity 77,000 bbl. Warbuilt pipe line from Portland, Me., U. S. A., to Montreal, to shortcut tanker haul, purchased by private companies and in operation. Active wildcatting campaign has been partially disappointing to date in foothills area on east flank of Rockies, but more encouraging in plains area near Alberta-Saskatchewan border. Lloydminster field there, although small, is second largest and may develop into something big.

ATHABASKA
EDMONTON
VERMILLION
LLOYDMINSTER
REDDEER
SASKATOON
CALGARY
TURNER VALLEY
PRINCESS
LETHBRIDGE
MOOSE JAW
REGINA
Winnipeg

HUDSON BAY

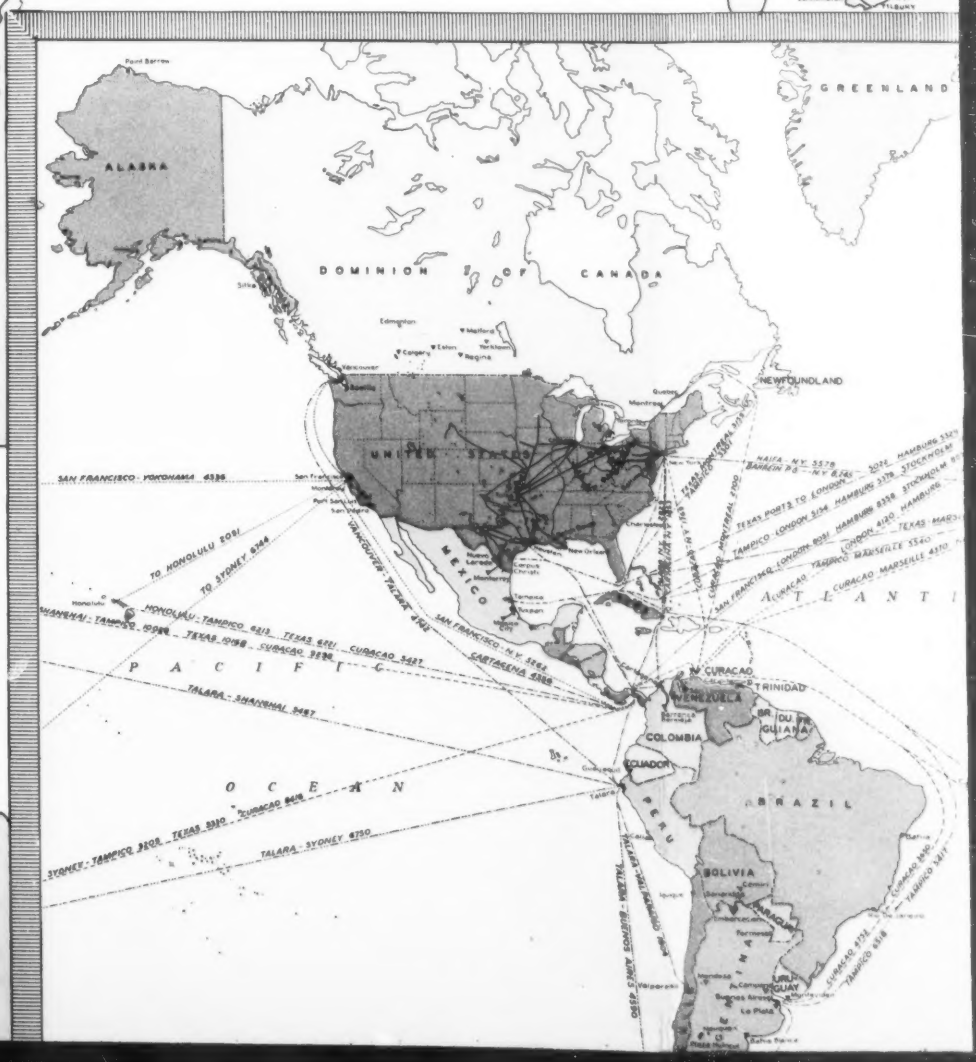
UNITED STATES

TORONTO

Campeche
Puerto Mexico
MINATITLAN
LA VENTA
FILISOLA
ISTHMUS REG.
Playa Obispo
BR. HONDURAS
Salina Cruz
GUATEMALA
Guatemala

VENEZUELA

Second largest oil country in world, with 1,100,000 bbl. daily production, and still increasing, with potential production and reserves promising much greater things. Laws on concession retention resulting in unusually high proportion wildcat testing and all other phases exploration activity. About 70 per cent present production in Western Venezuela, but eastern portion coming up rapidly. Present refining capacity 124,000 bbl., additional 165,000 bbl. under way. Bulk of crude exported, large amounts to adjacent islands of Aruba and Curacao, where


GREENLAND
ALASKA
DOMINION OF CANADA
NEWFOUNDLAND
UNITED STATES
MEXICO
PACIFIC OCEAN
ATLANTIC OCEAN
CURACAO
TRINIDAD
VENEZUELA
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
URUGUAY
SAN FRANCISCO - YOKOHAMA 4535
TO HONOLULU 5091
TO SYDNEY 6744
HONOLULU - TAMPICO 6813 - TEXAS 6911 - CURACAO 5427
SHANGHAI - TAMPICO 10088 - TEXAS 10168 - CURACAO 9238
SAN FRANCISCO - N.Y. 5262
CARTAGENA 4868
TALARA - SHANGHAI 9487
SYDNEY - TAMPICO 9808 - TEXAS 9930 - CURACAO 8416
TALARA - SYDNEY 6750
NAFTA - N.Y. 5578
BAHREIN P.G. - N.Y. 8760 - ROTT. HAMBURG 5923
TEXAS PORTS TO LONDON - ROTT. HAMBURG 5923
TAMPICO - LONDON 5134 - HAMBURG 5378 - STOCKHOLM
CHICAGO - MONTREAL 2100
TAMPICO - LONDON 5091 - HAMBURG 5358 - STOCKHOLM
SAN FRANCISCO - LONDON 6130 - HAMBURG
CURACAO - TAMPICO MARSEILLE 5540
TEXAS - MARSEILLE 5540 - MARS
CURACAO - LONDON 4130 - HAMBURG 4370 - MARSEILLE 4370
CURACAO MARSEILLE 4370
BUENOS AIRES - ROTTERDAM 6450
CURACAO 6776 - TAMPICO 6618
CURACAO 5490 - TAMPICO 5427

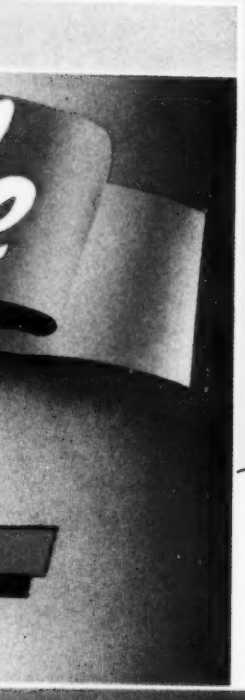
Journal-Guide TO WORLD OIL

EUROPE

Production 140,000 bbl. per day compared to prewar normal of 153,000 bbl. Refining capacity, on basis of data available, indicated about 360,000 bbl. crude charging capacity and 90,000 bbl. cracking capacity available on varying efficiency basis. This compared with 704,000 bbl. crude charging and 202,800 cracking capacities prewar. Current production divided: Romania 85,000 bbl., Austria 20,000 bbl., Hungary 15,000 bbl., and miscellaneous. Romanian refining facilities about 100,000 bbl. crude charge and 25,000 cracking versus 212,000 and 47,500 bbl. respectively in prewar. France operating about 44,000 bbl. crude charge and 15,000 bbl. cracking capacities versus prewar 156,500 bbl. and 70,600 bbl. respectively. Great Britain with postwar plants of 111,000 bbl. crude and 20,000 cracking capacities practically unchanged from prewar on net basis. Production everywhere held back by lack of materials for drilling and development. Refinery restoration making steady progress.

Supplement to The Oil and Gas Journal

Issue of December 28, 1946



U. S. S. R.

Production believed to have reached peak of 630,000 bbl. daily in early part of war. Recent unofficial information indicates petroleum industry hit harder by war than thought earlier. Now believed production fell as low as 400,000 bbl. daily during war when some 3,000 wells and 100,000 bbl. daily production lost, by capture, by sabotage when Germans neared fields, and by bombing damage. Shortage of equipment, supplies, and loss of skilled manpower accounted for remainder. Current production now believed as low as 500,000-550,000 bbl. daily. Prewar refining capacity 640,000 bbl. crude charging and 175,000 bbl. cracking capacity; current capacity unknown, but many refineries known to have been captured and demolished. Postwar plans call for 5-year development to 1,150,000-bbl. production, with greatest relative expansion in fields north of north end Caspian Sea and west of Ural Mountains, also east of southeast corner Caspian Sea.

LENINGRAD
YAREG
CHIB-YU
UST-KULOM
YAROSLOVL
IVANOVO
GORKI
MOSCOW
CHERDIN
Mts.
Ural
PERM AREA
KRASNOVKAMSK
OVERIATA
SVEROKAMSK
POLAZINSKY
UFA
Sverdlovsk
ROMNY
UKRAINE AREA
POLTAVA
Kiev
Vinnitsa
ODESSA
KHERSON
BERDYANSK
Nikitovka
Rostov
BUGURUSLAN
URAL AREA
CHELYABINSK
KUSIANKUL
ISHIMBAEVO
SHAKAEVO
ALLAGUVAT
KUZMINOVKA
YABLONOVO
SYZRAN
CRIMEAN AREA
ARMA ELI
CHONELEK
KOP KOCHEGEN
KERLEUT
MAYAK
MAIKOP AREA
Armavir
ADAGHUM
ABUZY
MAIKOP
KHADYZHI
KUTAISS
KURA-TSITSE
TUAPSE
Astrakhan
EMBA AREA
ORSK
NOVOBOGATINSK
ISKINE
DOSSAR
MAKAT
SAGIS
BAICHNAS
KURGUS
BATUM
TBILISE
GROZNY
BAKOVICHI
MALGOBEK
VOZNESSENKA
GORSKAYA
STARRO
NOVO GROZNY
ADI YURT
BENOI
GROZNY AREA
SIAZAN
SHURAABAB
ARTEM IS.
MAHOMEDLY
KALA
FALMAY
SIAN-SHOR
ETC.
BAKU AREA
KRASNOVODSK
TURKMEN AREA
NEBIT DAG
NEFTEDAG
Ashkhabab
CHU
KOMOSOL
ENCUMIMSAI
PITAUSA
MAILSAI
MANANGAN
BARZIK
ENO-SING
FERGANA AREA
ZARKENT
KAMISHBASHI
MELNIKOVO
PAVLANTASH
KIM
FERGANA
CHANGITASH
ANDIZHAN
AK-MECKET
CHIMMON
ISTANSANTO
KAUDAG
TERMEZ
DZHAR-KURGAN
PLOESTI AREA ENLARGED FOR GREATER DETAIL
BUSTENARI
RUNCU
PITIGAIA
BACURETI
BAICOI
TINTEA
LILIEST
BOLDESTI
GORGOTA
OCHIURI
PISCURI
CEPTURA
MORENI
MARGINENI
ARICESTI
CALINESTI
PLOESTI
BUSCANI
BRAZI
BUCHAREST
TANNUTUVA
Ulan Bator
MONGOLIA
DALAINOR
FUSHUN
MUKDEN
FUSIN
RYOJUN
Peiping
Tientsen
WU SU
Urumchi
TSINKIANG
YUMEN
CHINA
Nanking
Chungking
Canton
AFGHANISTAN
DHULIAN
RAWALPINDI
KHAUR
JOYA MAIR
TIBET
Lhasa
Delhi
NEPAL
BHUTAN
SADIA
DIGBOI
INDIA
Calcutta
INDAW
Mandalay
BURMA
SABE
Harbin
FINLAND
Helsinki
BLACK SEA
BULGARIA
Sofia
Istanbul
CRETE
ROMANIA
PLOESTI
BAKU
YEVLAKH
U. S. S. R.
IRAN
ASIA

INDIA.—Production 7,000 bbl. daily, 6,000 bbl. at Digboi in eastern part, 1,000 bbl. at Dhulian and Khaur in northwest. Refining capacity 10,000 bbl. skimming and 4,500 bbl. cracking; 6,000 and 2,500 bbl. at Digboi in east, balance at Rawalpindi in northwest.

BURMA.—Prewar production 21,000 bbl. daily with refining capacity 27,000 bbl. skimming and 6,000 bbl. cracking. Properties deliberately sabotaged during Jap invasion; disturbed political conditions preventing postwar rehabilitation. Estimated about 2,000 bbl. daily being produced by British military occupation forces.

JAPAN.—Prewar local production of 9,000 bbl. daily now down to 4,000 bbl. Of prewar refining capacity of 52,000 bbl. skimming and 16,000 bbl. cracking, tentative plans call for retaining only 12,000-14,000 bbl. refining capacity, remainder to be dismantled as reparations, possibly given to China. Currently only 2,000 bbl. per day of crude being refined.

U. S. S. R.

Production believed to have reached peak of 630,000 bbl. daily in early part of war. Recent unofficial information indicates petroleum industry hit harder by war than thought earlier. Now believed production fell as low as 400,000 bbl. daily during war when some 3,000 wells and 100,000 bbl. daily production lost, by capture, by sabotage when Germans neared fields, and by bombing damage. Shortage of equipment, supplies, and loss of skilled manpower accounted for remainder. Current production now believed as low as 500,000-550,000 bbl. daily. Prewar refining capacity 640,000 bbl. crude charging and 175,000 bbl. cracking capacity; current capacity unknown, but many refineries known to have been captured and demolished. Postwar plans call for 5-year development to 1,150,000-bbl. production, with greatest relative expansion in fields north of north end Caspian Sea and west of Ural Mountains, also east of southeast corner Caspian Sea.

LENINGRAD
YAROSLOVL
IVANOVO
GORKI
YAREG
CHIB-YU
UST-KULOM
CHERDIN
PERM AREA
KRASNOVKAMSK
OVERIATA
SVEROKAMSK
POLAZINSKY
Ural
Sverdlovsk
BUGURUSLAN
URAL AREA
CHELYABINSK
KUSIANKUL
ISHIMBAEVO
SHAKAEVO
ALLAGUVAT
KUZMINOVKA
SYZRAN
YABLONOVO
Astrakhan
EMBA AREA
ORSK
NOVOBOGATINSK
ISKINE
DOSSAR
MAKAT
SAGIS
BAICHNAS
KURGUS
KRASNOVODSK
TURKMEN AREA
NEBIT DAG
NEFTEDAG
Ashkhabab
FERGANA AREA
CHU
KOMOSOL
ENCUMIMSAI
PITAUSA
MAILSAI
MANANGAN
BARZIK
ENO-SING
ZARKENT
KAMISHBASHI
MELNIKOVO
PAVLANTASH
KIM
FERGANA
CHANGIRTASH
ANDIZHAN
AK-MECKET
CHIMMON
RISTANSANTO
KAUDAG
TERMEZ
DZHAR-KURGAN

A S I A

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BUSTENARI
RUNCU
BACURETI
TINTEA
LILIEST
BOLDESTI
CEPTURA
MARGINENI
PLOESTI
BRAZI
TANNUTUVA
Ulan Bator
MONGOLIA
DALAINOR
FUSHUN
MUKDEN
FUSIN
KANKO
Keijo
KOREA
Harbin
MANCHURIA
Urumchi
WU SU
SINKIANG
Peiping
Tientsen
RYOJUN
YELLOW SEA
YUMEN
CHINA
Nanking
Shanghai
TIBET
Chungking
Lhasa
Delhi
NEPAL
BHUTAN
SADIA
DIGBOI
KINSUI
SHIKKO
FORMOSA
Canton
INDIA
Calcutta
INDAW
Mandalay
BURMA
HIROSHIMA
KUDAMATSU
TOKUYAMA

UST MAYA
R
MOSKALVO
NIKOLAEVSK
SAKHALIN IS.
KOMSOMOLSK
KHABAROVSK
OKHA
EKHABI
MOSKALVO
ENLARGED SECTION OF SAKHALIN ISLAND
POLOMAI
NUTOVO
SAKHALIN
VIGREK
KATANGLI
ISLAND
MASUHORO
ISHIKARI
YUFUTSU
HIBIKI - OGUNI
OMO
TOKYO
JAPAN SEA
FOR GREATER DETAIL SEE ENLARGED MAP
MASHUHORO
HOKKAIDO
ISHIKARI
YUFUTSU
KARAGA-WA
HIBIKI
TOYOKAWA
KUROKAWA
MICHIKAWA
AKITA
ASAHIGAWA
OGUNI
FUNAKAWA
YURI
HIRASAWA
NIIGATA
NIITSU
NANOKAISHI
NISHIYAMA
KASHIWAZAKI
OMO
HIGASHIYAMA
KUBIKI
TOKYO
KAWASAKI
TSURUMI
YOKOHAMA
SHIMIZU
YOKAISHI
MITAKI
OSAKA
WAKAYAMA
SHIMOTSU

ARUBA
CURACAO
Las Piedras
GULF OF VENEZUELA
CARIBBE
CUMAREBO
Coro
Tetones
NETICK
LA PAZ
LA CONCEPCION
Maracaibo
TOTUMO
LAS PALMAS
HOMBRE PINTADO
MEDIA
EL MENE
LA SALINA
AMBROSIO
LA ROSA
PUNTA BENITEZ
TIA JUANA
LAGUNILLAS
BACHAQUERO
LAKE MARACAIBO
MENE GRANDE
SAN LORENZO
Valencia
Barquisimeto
San Carlos
Trujillo
RIO DE ORO
EL CUBO
TARRA
LOS MANUELOS
VENEZ
Merida
Barinas
San Cristobal

COLOMBIA

Present production about 60,000 bbl. daily, 30 per cent from Barco fields near Venezuelan border, 70 per cent from Demares and Yondo (Casabe) fields in mid-Magdalena Valley. Production does not reflect potentialities, which are being tested in most active wildcatting campaign in country's history. Drilling now twice last year's rates, mostly wildcats and extensions of proven fields not yet producing for export. A 16,000-bbl. refinery on Demares concession, a 700-bbl. plant on Barco. Two pipe lines to export terminals, one from Barco, one from Demares-Yondo. In addition to concessions shipping oil, production has been established at Cantagallo, Floresanto, El Dificil, Galan, and Velasquez, but no pipe line outlets exist for commercial shipment. The first three were found productive in 1943, Galan in 1945, and Velasquez in 1946. Additional pipe line outlets to seaboard will be necessary for this country to achieve its potentialities.

Barranquilla
Cartagena
Coveñas
DIFICIL
RIO DE ORO
TIBU
PETROLEA
CASABE
BARRANCA BERMEJA
CANTAGALLO
GALAN
LA CIRA
INFANTAS
VENEZUELA
COLOMBIA
Bogota
Mitu

ECUA

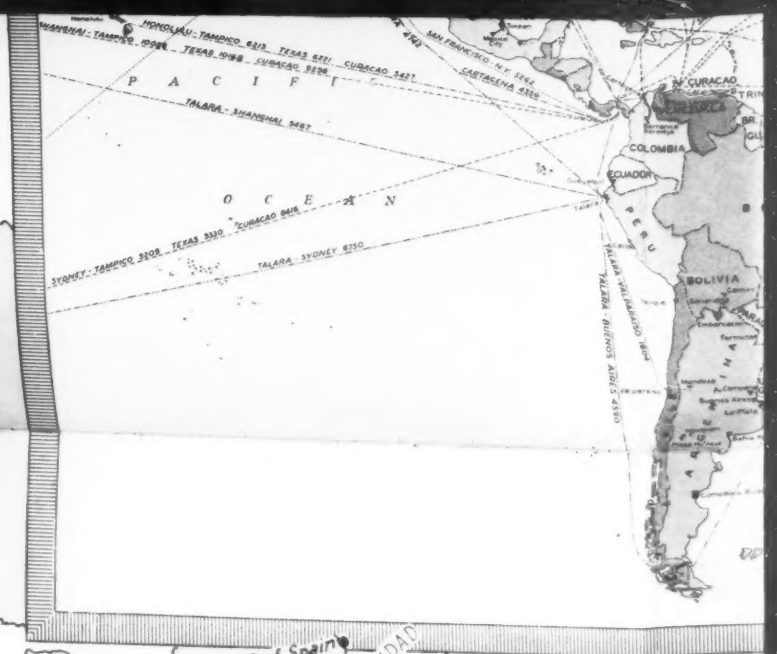
Present production about
half refined in two local
one small plant shut down.
Relatively active explorati
tional Petroleum Co. com
at 13,206 and 10,500 ft. re
sidiary drilled 5,000-ft. d
Andes in Oriente, now dri
International has two rigs
ft. to be flown over Ande
The Ancon field, with ove
ft. deep, accounts for 70 p
try's production. All fields
Peninsula, producing fro
sands. Oil is found in frac
source may be Cretaceou
offers possibilities up-dip,
As in Colombia and Peru,
in wildcatting in the Orie
of the Andes.

E C U
PETROPOLIS
LA LIBERTAD
Salinas
EL CAUTIVO
CAROLINA
STA. PAULA
ANCON
STA ELENA
GULF OF GUAYAQUIL

Charles J. Dorgan

VENEZUELA

Second largest oil country in world, with 1,100,000 bbl. daily production, and still increasing, with potential production and reserves promising much greater things. Laws on concession retention resulting in unusually high proportion wildcat testing and all other phases exploration activity. About 70 per cent present production in Western Venezuela, but eastern portion coming up rapidly. Present refining capacity 124,000 bbl., additional 165,000 bbl. under way. Bulk of crude exported, large amounts to adjacent islands of Aruba and Curacao, where refining capacity is 500,000 bbl. daily. Present production from about 2,100 flowing and 2,800 pumping wells in 37 active fields, well average about 225 bbl. daily. About 700,000 bbl. daily from wells less than 3,500 ft. deep; 200,000 bbl. from wells 3,500-5,000 ft. in depth. Creole Petroleum Corp. production of about 600,000 bbl. daily makes it world's largest single producing company.



ADOR

about 6,500 bbl. daily, about local refineries operating, own. Some crude exported. oration campaign. International completed two dry holes, t. respectively. Shell subt. dry hole east side of w drilling on second hole. rigs good for 8,000-10,000 Andes to drill in Oriente. over 500 wells, 1,200-1,800 70 per cent of the country fields are on the St. Elena from Eocene Tertiary fractures in sand and its aceous. If so, Cretaceous -dip, closer to mountains. eru, there is great interest Oriente, on the east side

TRINIDAD

Production about 55,000 bbl. daily, two refineries with 75,000 bbl. capacity import remainder of requirements from nearby Venezuela. Principal fields in 20-by-30-mile area, off about 5,000 bbl. daily since 1940. Most past production from Miocene Tertiary, recent developments getting substantial production from Oligocene Tertiary, Cretaceous possibilities. Active exploration campaign, 8 out of 24 rigs running are on wildcats. Government has granted concessions for offshore drilling within 3-mile limit around south coast in Gulf of Paria. Ultimately expected Trinidad and Venezuela will join to permit development entire Gulf of Paria between two countries, if technically feasible. The Forest Reserve field, with over 600 wells still producing, accounts for about half the island's production. Drilling is complicated by abnormally high formation pressures, frequently up to 800 lb. per 1,000 ft. of depth. Muds up to 130 lb. per cu. ft. are used.

PERU

Production about 32,000 bbl. daily, declining 10 per cent per year, despite drilling over 100 wells per year. Agua Caliente (Ganso Azul), isolated field on eastern side of Andes, has five wells 1,000 ft. deep, potential 1,800 bbl. daily, producing 500 bbl., which is skimmed in adjacent refinery, marketed in interior and down Amazon River. Coastal area has two refineries, International Petroleum Co. 26,000 bbl. complete plant and government-owned 1,000-bbl. skimming plant. New petroleum law under consideration may result in substantial increase in activity. Peru important as only large producer on west coast of South America and has large potential export market. Exploration campaigns mapped out for Sechura desert area, south of present coastal fields, and for more tests on east side of Andes. Ganso Azul is to have more development to see if big enough reserves for a long pipe line can be established.

ELA

SEA

La Asunción

Cumana

Puerto La Cruz

AMARE

JUSEPÍN
MULATA

CARIPITO
QUIRIQUIRE

Maturin

TRAVIESO

STA. BARBARA

STA ROSA
GUARIO

Cantaura

W. GUARA

LEONA

E. GUARA

MEREY

AVENTAZON

OFICINA

YOPALES

CARITOS

TUCUPITA

Tucupita

URACOA

PILON

TEMBLADOR

Ciudad Bolivar

San Fernando

TABAQUITE

POINTE-À-PIERRE

POINT D'OR

PITCH LAKE
OIL CENTRE

KERN-PERRY LAND-CAL

POINT
FORTIN

BOODOOSINGH

VESSIGNY

PENAL

BARRACKPORE

LIZARD SPRINGS

W PT FORTIN
CENT PT FORTIN
E PT FORTIN

FOREST RESERVE

LOS BAJOS

COORA

CEDROS

GUAYAGUAYARE

AGUA CALIENTE

TRINIDAD

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is five wells
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adjacent re-
own Amazon
ries. Interna-
mplete plant
. skimming
consideration
in activity.
acer on west
rge potential
igns mapped
n of present
east side of
development
a long pipe

PACIFIC OCEAN

ATLANTIC OCEAN

CURACAO

TRINIDAD

COLOMBIA

ECUADOR

PERU

BRAZIL

BOLIVIA

PARAGUAY

URUGUAY

CHILE

ARGENTINA

FRENCH W

Port of Spain

TRINIDAD

PT. D'OR

PT. FORTIN

TABAQUITE

PT A PIERRE

PEDERNALES

FOR GREATER DETAIL OF TRINIDAD, REFER TO ENLARGED SECTION

Cochabamba

La Paz

BOLIVIA

TinTin

Sucre

SAIP

CAMI

B.VISTA

CAMA

SANA

BERMEJO

SAN PEDRO

AGUA BLANCA
RIO PESCADO

CERR
LOM
TRA
RAMO

LOMIT

EMBAR

Antofagasta

SALTA

Salta

Mendoza

CACHEUTA

LUNLUNTA
BARRANCAS

Santiago

REFUGIO
TUPUNGATO

San Rafael

EL SOSNEADO

Villa Maria

SAI

B

PLAZA HUINCUL

Plaza Huincul

Puerto Montt

M.BEHR OESTE
C. PERDIDO

TREBOL

Comodoro Rivadavia

TORDILLO

CALETA OLIVIA

Santa Cruz

Rio Grande

AF

CH WEST AFRICA
NIGERIA
ANGLO EGYPTIAN SUDAN
ITALIAN EAST
FRENCH EQUATORIAL AFRICA
BELGIAN CONGO
KENYA
TANGANYIKA
ANGOLA
RHODESIA
MOZAMBIQUE
S.W. AFRICA
BECHUANALAND
UNION OF SOUTH AFRICA
MADAGASCAR
INDIAN OCEAN
CEYLON
THAILAND
PHILIPPINE ISLANDS
SUMATRA
BORNEO
NEW GUINEA
AUSTRALIA
Brisbane
Sydney
Melbourne
Adelaide
Canberra
NEW ZEALAND
Wellington
DHULIAN
KHAUR
JOYA MAIR
Delhi
ARABIAN SEA
Bombay
Madras

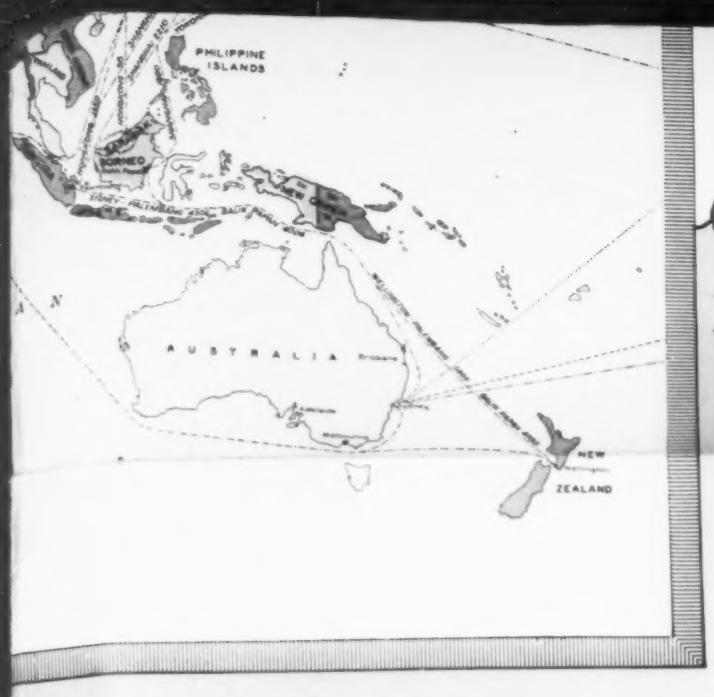
A
SAIPURU
CAMIRI
VISTA
CAMANTINDI
SANANDITA
CERRO TARTAGAL
LOMITAS
TRANQUITAS
RAMOS
LOMITAS
MBARCACION
PARAGUAY
BRAZIL
URUGUAYANA
SAN LORENZO
RIO GRANDE
Rio Grande
URUGUAY
CAMPANA
Campana
BUENOS AIRES
Buenos Aires
LA PLATA
MONTEVIDEO
Montevideo
BAHIA BLANCA
RGENTINA

BLACK SEA
GROZNY
RUSSIA
CASPIAN SEA
Ankara
TURKEY
BAKU
CYPRUS
MEDITERRANEAN SEA
Tripoli
SYRIA
AIN ZALAH
QAIYARAH
Mosul
JAWAN QUSAB
NAJMAH
KIRKUK
TRIPOLI
Beyrouth
LEBANON
Damas
Haifa
HAIFA
NAFT KHANEH
Alward
KHANAQIN
KERMANSHAH
NAFT-I-SHAH
Baghdad
IRAQ
Tehran
Port Said
PALESTINE
TRANS-JORDAN
Cairo
SUEZ
Suez
EGYPT
RAS GHARIB
HURGHADA
RED SEA
LALI
MASJID-I-S
HAFT-K
ABADAN
Abadan
AGHA
PAZA
GAC
Kuwait
BURGHAN
PERSI
ABU HADRIYA
RAS TANURA
QATIF
DAMMAM
ABQAIQ
DUKHAN
SAUDI ARABIA
Medina
Riyadh
Jeddah
Mecca
MIDD
SUDAN
ERITREA
GULF OF ADEN

Argentina produces 60,000-65,000 bbl. daily, divided among regions north to south as follows: Salta 10 per cent, Mendoza 14 per cent, Plaza-Huincul 10 per cent; and Comodoro Rivadavia 70 per cent. Refines entire domestic output plus 3,000-10,000 bbl. daily imported crude. Whole industry in need of thorough reequipping account none received during war. Industry about 65 per cent government owned, 35 per cent private companies, but expansion of private companies legally almost impossible. At Caleta Olivia, about 60 miles south of Comodoro Rivadavia, the Government has a potentially big discovery.

Bolivian fields near northern Argentine border, potential production about 6,000 bbl. daily, outlet limited to about 1,000 bbl., part refined and part exported to Argentina. Plans expansion production, refining, and construction of pipe line to populated centers partly with U. S. Government loan. Industry government owned and operated.

Production 769,000 b
ing 709,000 bbl., crackin
QATAR: Two wells,
KUWAIT: One field
SAUDI ARABIA: T
bbl. crude charging capa
balance at Bahrein Islan
Abquaiq 70,000 bbl. fro
from 1 well; Abu Hadri
IRAN: Five produci
Abadan refinery 400,00
manshah plant 2,000 bb
000 bbl. from 23 wells;
from 8 wells; Bach-Sa
Pazanum 3 wells shut
IRAQ: Two fields h
crude capacity, no crac
from 1 well. Proved su
EGYPT: Two prod
62 wells respectively. T
PALESTINE: One
bbl. cracking capacity.



DHULIAN
KHAUR
JOYA MAIR
TIBET
Lhasa
Delhi
NEPAL
BHUTAN
INDIA
Calcutta
ARABIAN SEA
Bombay
AKYAB
SINGU
KYAUKPYU
YENANMA
RANGOON
Madras
BAY OF BENGAL

BLACK SEA
GROZNY
RUSSIA
BAKU
CASPIAN SEA
Ankara
TURKEY
AIN ZALAH
QAIYARAH
Mosul
NAJMAH
JAWAN
QUSAB
KIRKUK
Tehran
CYPRUS
SYRIA
MEDITERRANEAN SEA
Tripoli
TRIPOLI
Beyrouth
Damas
NAFT KHANEH
Alward
KHANAQIN
KERMANSHAH
NAFT-I-SHAH
Baghdad
Haifa
HAIFA
PALESTINE
TRANS-JORDAN
IRAQ
LALI
MASJID-I-SULAIMAN
HAFT-KEL
Port Said
SUEZ
Suez
Cairo
ABADAN
Abadan
AGHA JARI
PAZANUM
GACH SARAN
Kuwait
BURGHAN
PERSIAN GULF
RAS GHARIB
EGYPT
HURGHADA
ABU HADRIYA
RAS TANURA
QATIF
DAMMAM
ABQAIQ
BAHREIN
DUKHAN
QATAR
GULF OF OMAN
RED SEA
SAUDI ARABIA
Medina
Riyadh
Jeddah
Mecca
SUDAN
ERITREA
GULF OF ADEN

MIDDLE EA

Production 769,000 bbl. daily from 283 wells; refining capacity in 8 pl
ing 709,000 bbl., cracking capacity 179,300 bbl.

QATAR: Two wells, currently shut in.

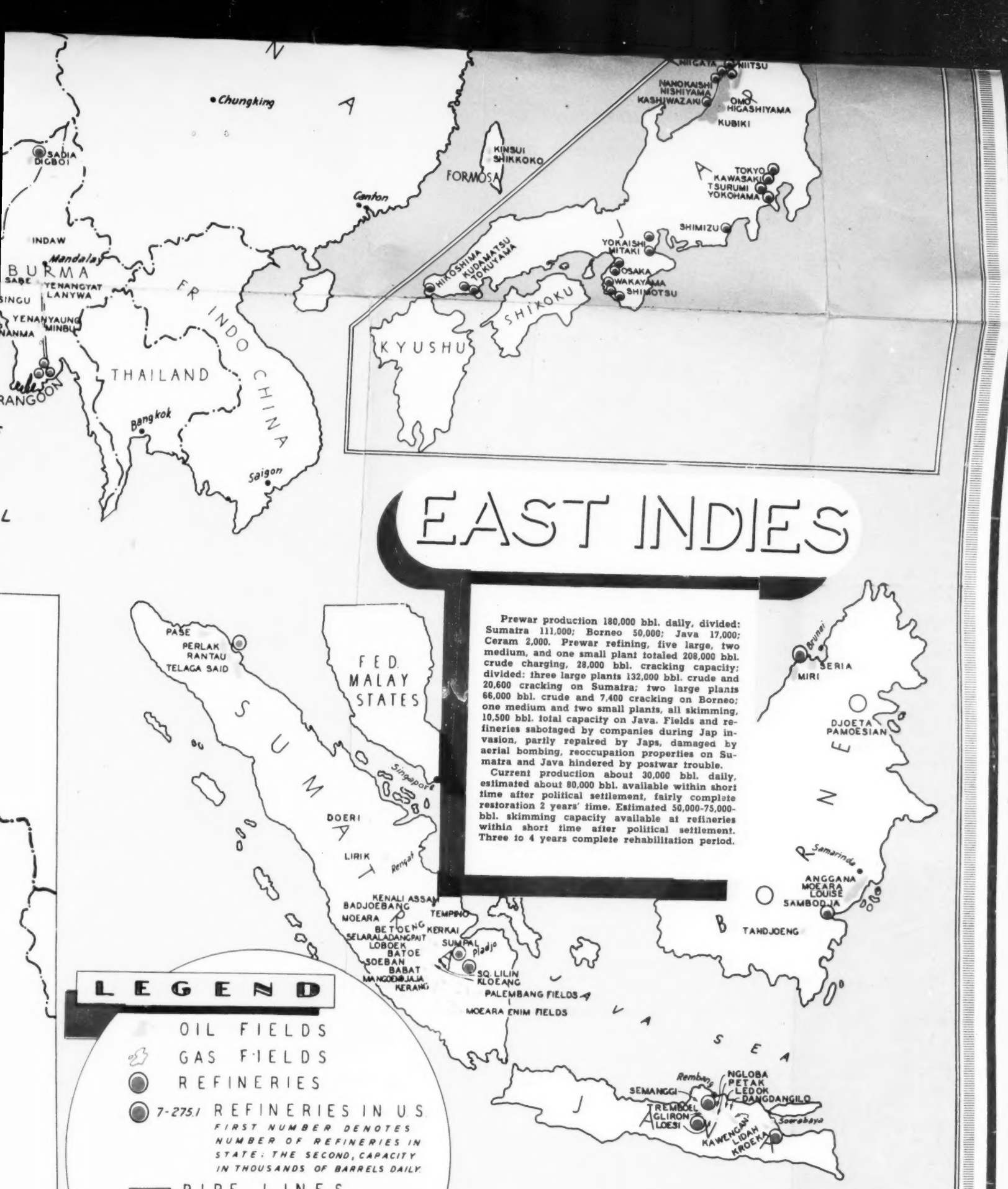
KUWAIT: One field, five wells, 30,000 bbl. daily production, no refi

SAUDI ARABIA: Total production 196,000 bbl. daily production from
bbl. crude charging capacity, 15,000 bbl. cracking; 90,000 bbl. crude capac
balance at Bahrein Island plant. Production by fields: Damman 100,000 b
Abqusiq 70,000 bbl. from 6 wells; Bahrein Island 23,000 bbl. from 62 wel
from 1 well; Abu Hadriya field shut in. This summary includes Bahrein

IRAN: Five producing fields, 422,000 bbl. daily from 63 wells; 1 fiel
Abadan refinery 400,000 bbl. crude charge capacity, 125,000 bbl. cracki
manshah plant 2,000 bbl. crude capacity, no cracking. Production by fie
000 bbl. from 23 wells; Manid-i-Sulaiman 100,000 bbl. from 27 wells; Ag
from 8 wells; Bach-Saran 40,000 bbl. from 3 wells; Naft-i-Shah 2,000
Pazanum 3 wells shut in.

IRAQ: Two fields being produced—96,000 bbl. from 11 wells; Alward
crude capacity, no cracking. Kirkuk field 90,000 bbl. from 10 wells, Naft
from 1 well. Proved sustained productive capacity all fields 350,000-400,0

EGYPT: Two producing fields, Ras Gharib 25,000 bbl., Hurghada 1,00
62 wells respectively. Two refineries at Suez, 36,800 bbl. crude capacity,
PALESTINE: One refinery at Haifa, capacity 63,000 bbl. crude char
bbl. cracking capacity, drawing oil from Iraq via pipe line.



Prewar production 180,000 bbl. daily, divided: Sumatra 111,000; Borneo 50,000; Java 17,000; Ceram 2,000. Prewar refining, five large, two medium, and one small plant totaled 208,000 bbl. crude charging, 28,000 bbl. cracking capacity; divided: three large plants 132,000 bbl. crude and 20,600 cracking on Sumatra; two large plants 66,000 bbl. crude and 7,400 cracking on Borneo; one medium and two small plants, all skimming, 10,500 bbl. total capacity on Java. Fields and refineries sabotaged by companies during Jap invasion, partly repaired by Japs, damaged by aerial bombing, reoccupation properties on Sumatra and Java hindered by postwar trouble.

Current production about 30,000 bbl. daily, estimated about 80,000 bbl. available within short time after political settlement, fairly complete restoration 2 years' time. Estimated 50,000-75,000-bbl. skimming capacity available at refineries within short time after political settlement. Three to 4 years complete rehabilitation period.

WORLD PRODUCTION AND CAPACITY OF REFINERIES.

(1,000 bbl. daily)

Country—	Production	Refining capacity: Crude charge	Refining capacity: Cracking
North America:			
Canada	21	245	78
Cuba	1	4	2
Mexico	129	152	14
United States	4,800	5,300	3,150
Subtotal	4,951	5,701	3,244
South America:			
Argentina	62	94	56
Bolivia	1	1	0
Brazil	1	7	0
Chile	0	1	0
Colombia	60	17	0
Ecuador	6	2	0
Peru	32	28	7
Trinidad	55	75	30
Uruguay	0.	6	2
Venezuela	1,100	124	35
Aruba and Curacao	0	560	240
Subtotal	1,317	915	370
Europe—excl. Russia:			
Austria	20	16	0
Belgium	0	11	4
British Isles	1	111	20
France	1	44	15
Germany	13	(*)	(*)
Hungary	15	12	1
Italy	1	4	7
Netherlands	1	18	12
Poland	2	21	2
Portugal	0	6	0
Romania	85	100	25
Sweden	0	4	3
Yugoslavia	0	5	0
Misc. Europe	3	10	0
Subtotal	142	362	89
Russia	(*)	(*)	(*)
Middle East:			
Egypt	26	37	6
Iran	422	402	125
Iraq	96	7	0
Kuwait	30	0	0
Palestine	0	63	33
Qatar	(†)	0	0
Saudi Arabia (Bahrein)	196	200	15
Subtotal	770	709	179
East Indies:			
Borneo, Java, Sumatra, Ceram	35	63	(*)
Subtotal	35	63	(*)
Far East:			
Burma	2	(*)	(*)
China	1	1	0
India	7	10	5
Japan	4	13	(*)
Subtotal	14	24	5
Australia	0	6	1
Miscellaneous	1	1	0
World total excl. Russia	7,230	7,781	3,888

*Data unavailable due to conditions resulting from war. †Shut in.

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Tulsa, Oklahoma

AST

8 plants, crude charg-

refining.
from 101 wells, 200,000
apacity at Ras Tanura,
000 bbl. from 31 wells;
wells; Qatif 3,000 bbl.
ein Island.
field 3 wells shut in.
acking capacity. Ker-
fields: Haft-Kel 200,-
Agha-Jiri 80,000 bbl.
000 bbl. from 2 wells,

ard refinery 7,000 bbl.
Naft-Khaneh 6,000 bbl.
00,000 bbl. daily.
1,000 bbl. from 38 and
ty, 6,300 bbl. cracking.
harge capacity, 33,000